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Petrography and Lithostratigraphy of Some South Louisiana Subsurface Tertiary Rocks.

Stuart T. Watson
Louisiana State University and Agricultural & Mechanical College

PETROGRAPHY AND LITHOSTRATIGRAPHY OF SOME SOUTH LOUISIANA SUBSURFACE TERTIARY ROCKS

A Dissertation

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by

Stuart T. Watson
A. B., Simpson College, 1953
M. S., University of Nebraska, 1955
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ABSTRACT

The Neogene clastic rocks underlying south Louisiana represent a generally regressive phase of sedimentation with minor transgressive interludes. These rocks thicken from 2000 feet where they outcrop at the surface to an estimated 30,000 feet or more in the subsurface near the Louisiana coast. In the past, three major divisions have been recognized: massive sand at the top, interfingered sand and shale, and massive shale at the base. These major units have been attributed to continental, neritic, and bathyal depositional environments, respectively. Some of these rocks are important as source beds and reservoirs of hydrocarbons, and the more precise lithic descriptions presented here may aid in predicting their occurrence.

Within the prism of Neogene sediments, thirteen different rock types can be defined from well cuttings. Definition is based on properties of general lithology, grain size, and color. Because one or two rock types dominate certain parts of the stratigraphic column, the Neogene prism can be divided into five lithosomes. This subdivision permits the more refined classification of the depositional environments and patterns of the sediments.

Lithosome I is characterized by rounded pebbles and cobbles of dark gray, light gray, and buff

chert and silicified oolite. These sediments are interpreted as supralittoral, fluvial deposits because of very coarse detritus, abundance of terrigenous plant material and iron oxide, and absence of marine faunas.

Lithosome II is characterized by light olive-green soft smooth clays, light gray, bentonitic clays, light buff silts, and coarse white to light buff sands. These sediments are considered to be littoral, fluvial deposits because of presence of abundant plant material and thick coarse sands, and paucity of marine faunas.

Lithosome III is characterized by shell beds and lignites, interbedded with sands ranging widely in grain size, and with light olive and light gray clays. These sediments are considered to be shallow neritic, littoral, or paludal deposits because of presence of molluscan shell beds, lignites and coals, and arenaceous foraminifera.

Lithosome IV is characterized by massive, smooth, uniform, blocky to platy, medium gray shale. These deposits are considered to be shallow to middle neritic because of the fine grain size, paucity of sand and plant material, and presence of calcareous foraminifera.

Lithosome V is characterized by very dark gray-brown, brittle, somewhat resistant, tabular to splintery, calcareous clay shale. The sediments are considered to have been deposited in outer neritic and shallow bathyal

regions of the continental shelf and slope because of continuous deposition of fine sediment with enclosed deep water fauna. Local concentrations of sandstone and siltstone in this lithosome are attributed to deltaic progradation to the shelf edge.

This refinement of the lithic subdivision may lead to the more accurate prediction of hydrocarbon location. Petroleum reserves should not be anticipated in Lithosomes I and II because of the unfavorable continental aspects of the depositional environments. Large reserves can be expected in lithosome III where salt domes or other large structures have sufficient closure to trap fluids in thick sands. In lithosome IV, petroleum would be trapped in the thin sandstones even by subtle structures, and in stratigraphic sand pinch-out traps. Prospects are good in lithosome V only where deltaic conditions concentrate marine organisms and erratically distributed sandstone reservoirs are present.

CHAPTER I

LOCATION AND PURPOSE OF STUDY

For more than forty years, deep drilling in search of oil and gas reserves has provided geologists with samples of the Tertiary rocks which underlie south Louisiana. This study is concerned with a fifteen parish area extending from the region of Miocene surface exposures in central Louisiana to the Gulf of Mexico (Fig. 1).

This area is part of the Cenozoic belt of the Coastal Plain physiographic province, where maturely dissected plains and Pleistocene terraces are overlapped by alluvial deposits. The geologic setting is the Gulf Coast geosyncline, where Neogene clastic rocks represent a generally regressive sedimentary episode, with minor transgressive interludes.

The Neogene rocks offlap as a stack of wedges which together thicken from 2000 feet, where truncated at the surface (Rainwater, 1964) to an estimated 30,000 feet or more near the Louisiana coast (Murray, 1961). These rocks have been studied in connection with lithologic, biostratigraphic, and environmental investigations. Applin, et al (1925) described gray and greenish gray sand and sandy clay, red clay, oyster shell marl, chert pebble beds, and unctuous shales in connection with biostratigraphic findings. Bornhauser (1947) recognized from well data

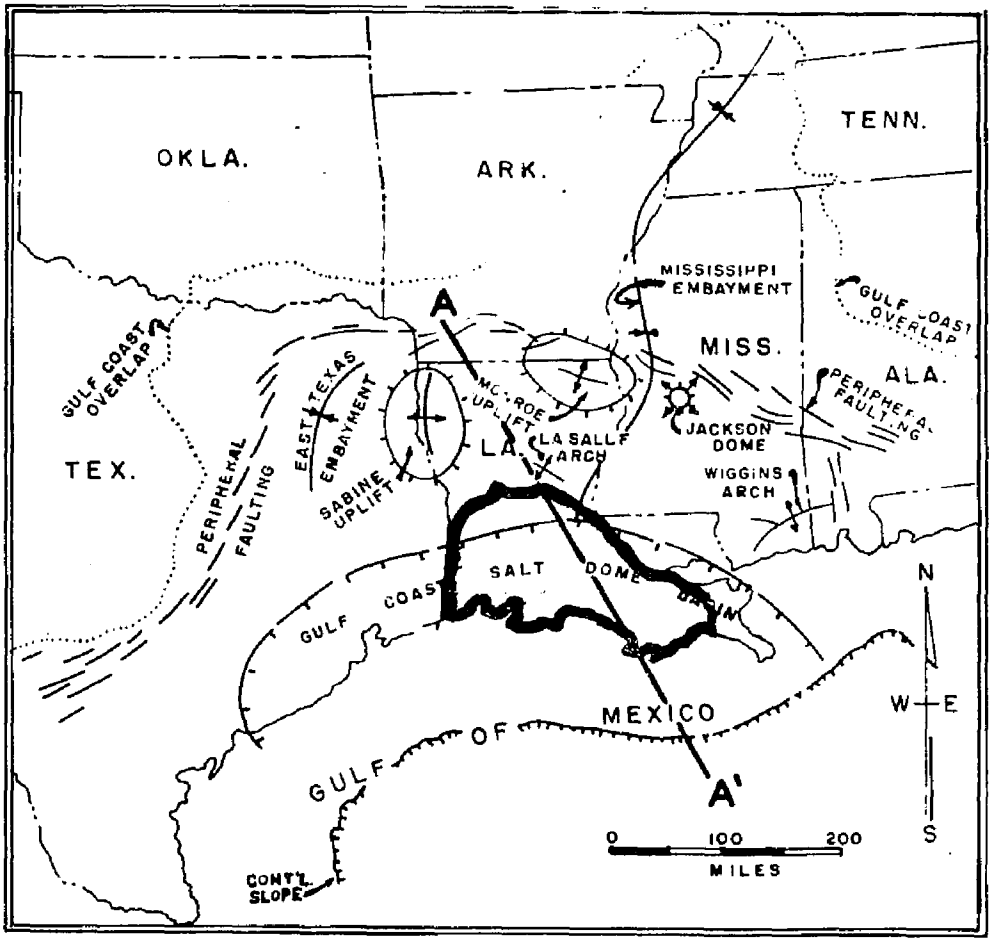
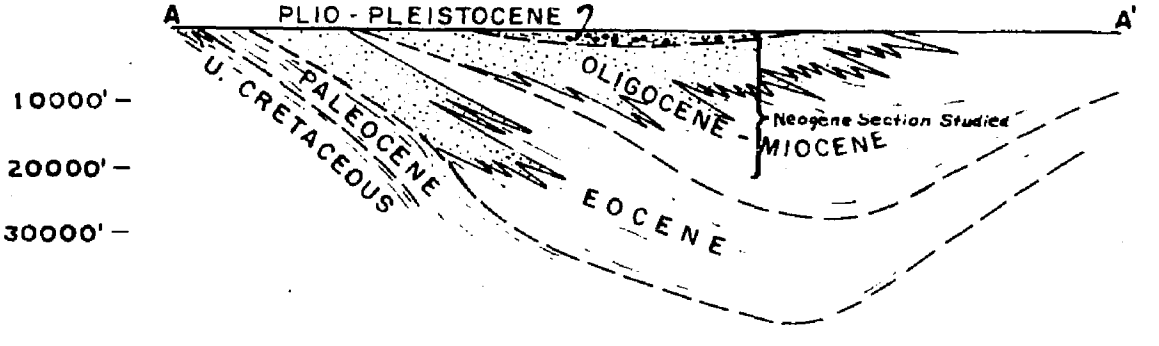


Figure -1-



STRATIGRAPHIC CROSS-SECTION

After Sellards, 1954, Murray, 1961

LOCATION AND REGIONAL GEOLOGIC SETTING OF THE AREA STUDIED

that distinctive lithic characters illustrated a three phase sedimentary cycle. He found reworked products of underlying deposits in an initial transgressive phase, fine clastics, mostly shale, in the inundative phase; and in the regressive phase, coarse clastics with shales, lignites, or calcareous sediments. A tripartite sequence of massive sand, interbedded sand and shale, and shale facies are well known, and classed by Thorsen (1964) according to sand percentage analysis of electric logs. Likewise, Lowman (1949) and Murray (1961) postulated that the three facies represent continental, neritic, and bathyal depositional environments, respectively, and confirm these lithic divisions.

Thus, the existing lithologic classifications group all rocks of the subsurface Neogene into three sedimentary facies composed of two basic types of rocks (sand and shale). These rock types are said to be distributed in two sedimentary patterns (massive and interfingered). Three environments are believed to have controlled sedimentary processes.

The purpose of this study is to determine whether the stratigraphic subdivision of subsurface Neogene rocks can be improved by more precise examination of available rock data. Such an increase in precision is considered feasible because of the results of previous investigations. Occurrence of numerous rock types has

been reported by subsurface workers. Broad transitional boundaries separating the three facies, suggest a need for more precise subdivision. Finally, the surface Miocene section of central Louisiana (Fig. 2) has been subdivided into seven recognizable members on the basis of lithology (Fisk, 1938).

The economic importance of the rocks has stimulated their study and subdivision. Hydrocarbons are believed to be generated in fine-grained rocks, rich in organic remains. Coarse-grained rocks serve as reservoirs, where contiguous with source beds. A better classification of the rocks is needed in order to predict the occurrence of petroleum reserves more accurately.

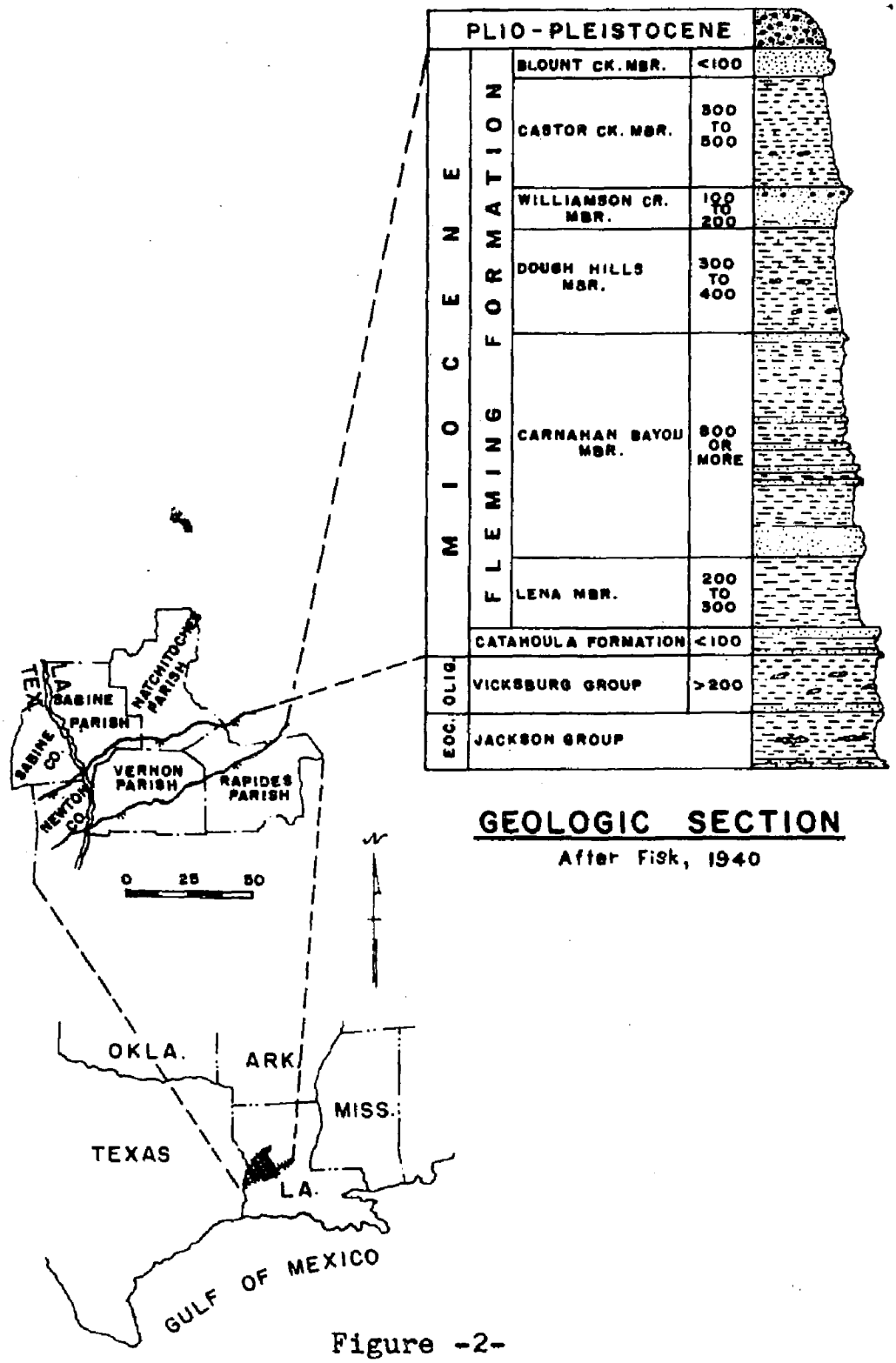


Figure -2-

LOCATION AND DISTRIBUTION

GENERALIZED GEOLOGY OF AGE-EQUIVALENT SURFACE ROCKS

CHAPTER II

METHODOLOGY

The subdivision of the prism of Neogene sediments entails the description of all easily recognizable rock types, and the determination of their associations and position in the rock column. Available rock samples consist of drill bit cuttings and cores and are therefore limited to geographic locations and stratigraphic intervals where wells have been drilled.

Samples are classified into kinds of rocks on the basis of visually estimated data from cuttings (Fig. 3): general lithology, phi grain size (Phi = -log 2 diam in mm) and color. Bedding and other sedimentary structures could be determined from cores, and correlated with the cutting data (Fig. 4). Mineral composition is determined from thin sections of cores.

The categorization of rock types is followed by the determination of their distribution in each well. Occurrence, association, and thickness patterns of rock types permits the recognition of groupings or sequences which comprise major stratigraphic units.

Comparison of the various rock columns from all wells suggests lateral continuity of rock types from well to well and precise tests determine the validity of such lithic subdivisions.

ROCK PROPERTIES

ROCK TYPES	GENERAL LITHOLOGY	GRAIN SIZE	COLOR	THICKNESS OF UNITS	COMMON ASSOCIATES
1	chert gravel; sand matrix	0ϕ	orange	300-500'	2-7-8
2	sand	0-2ϕ	buff, white or lt.gray	100-300'	1-3-7-8
3	sand	2-3ϕ	"	50-100'	all types
4	sand	3-4ϕ	"	10-50'	6-9-10
5	silt	4-8ϕ	light, olive-green	100-300'	2-3-4-11-12
6	silt	4-8ϕ	medium, gray-brown	50-100'	3-4-9-10
7	clay	8ϕ	light olive-green	100-300'	2-3-4-5-11-12
8	clay	8ϕ	light gray	100-300'	2-3-4-5-11-12
9	shale	8ϕ	medium gray	300' +	3-4-6-10
10	shale	8ϕ	dark gray-brown	500' +	4-6
11	lignite	--	very drk. brown to black	seams to a few inches	2-3-4-5-7-8-12
12	shell beds	-	buff or gray	50-150'	2-3-4-5-7-8-11
13	others	-	**red-brown clay and silt, anhydrite, etc.**		

ROCK TYPES DEFINED FROM WELL CUTTINGS Figure -3-

ROCK PROPERTIES

	GENERAL LITHOLOGY	GRAIN SIZE	COLOR	SEDIMENTARY STRUCTURES
ROCK TYPES 3	sandstone	2-3ϕ	light gray	massive, sub-massive, planar
4	sandstone	3-4ϕ	light to medium gray	planar, organic structures
6	siltstone	4-8ϕ	medium to dark gray-brown	random orientation of inclusions
10	shale	8ϕ	very dark gray-brown	massive, planar
13	siltstone (others)	4-8ϕ	red-brown	color variegation

ROCK PROPERTIES

	LITHOLOGIES	GRAIN SIZES	COLORS	SEDIMENTARY STRUCTURES
MIXED ROCKS 3 / 4	sandstone	2-3ϕ / 3-4ϕ	light gray	textural intercalation
4 / 6	sandstone / siltstone	3-4ϕ / 4-8ϕ	medium gray and light brown	random orientation of inclusions, intercalation, organic structures, disrupted bedding flow structures, and pseudo-breccia
6 / 10	siltstone / shale	4-8ϕ / 8ϕ	dark gray and gray-brown	planar, intercalation, disrupted bedding

ROCK TYPES DESCRIBED FROM CONTINUOUS CORES Figure -4-

CHAPTER III

TECHNIQUE

Rock samples were chosen for study on the basis of availability and representative distribution throughout the area (Fig. 5). The drill-bit cuttings, recovered at 10 or 20 foot intervals represent 150,000 total feet of section in 40 wells (Appendix B). For supplemental data, continuous cores of 135 feet of section in two Acadia Parish wells were also studied (Appendix C). Cuttings were left unwashed to avoid disaggregation of loosely consolidated sediment. Cores were split in half to expose fresh surfaces for structure studies, and 16 thin sections of some core samples were analyzed by the point count method (Appendix D).

To classify the rocks, samples were examined under the binocular microscope using X13 and X30 magnification. Color was described for hue and value according to the National Research Council Rock Color Chart. Values ranged from light (8-7), through medium (6-5) to dark (4-2) on the neutral scale, and hues ranged from 5YR 2/1 to 5/2 and 5Y 2/1 to 5/2. Grain size was described as coarse sand ($<1\phi$), medium sand (1 to 2ϕ), fine sand (2 to 3ϕ), very fine sand (3 to 4ϕ), silt (4 to 8ϕ), and clay ($>8\phi$). Fracture of shales was designated blocky, platy, tabular, or splintery. Roundness of grains was noted as round, sub- round, sub-angular,

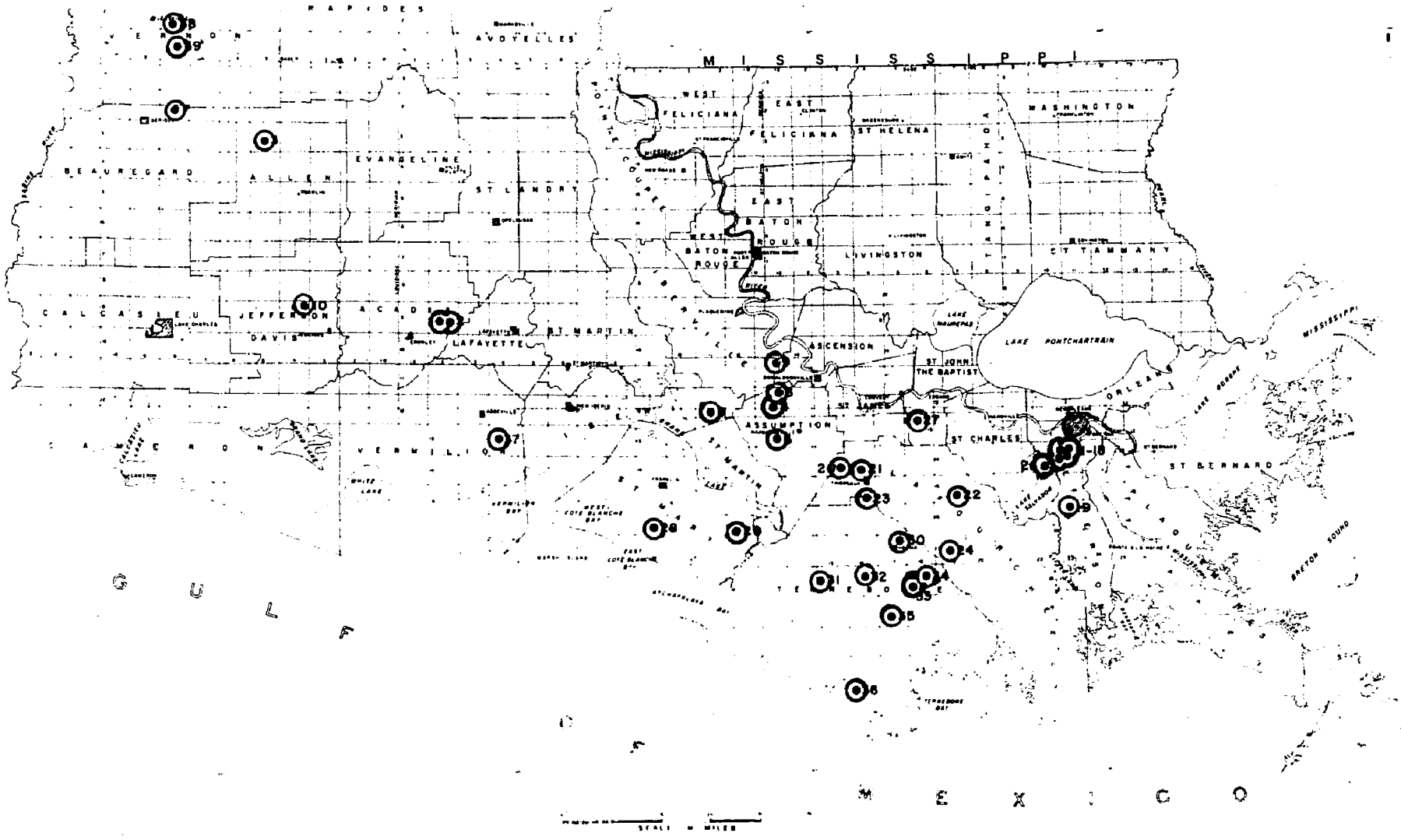


Figure -5-

LOCATION OF WELLS EXAMINED IN STUDY

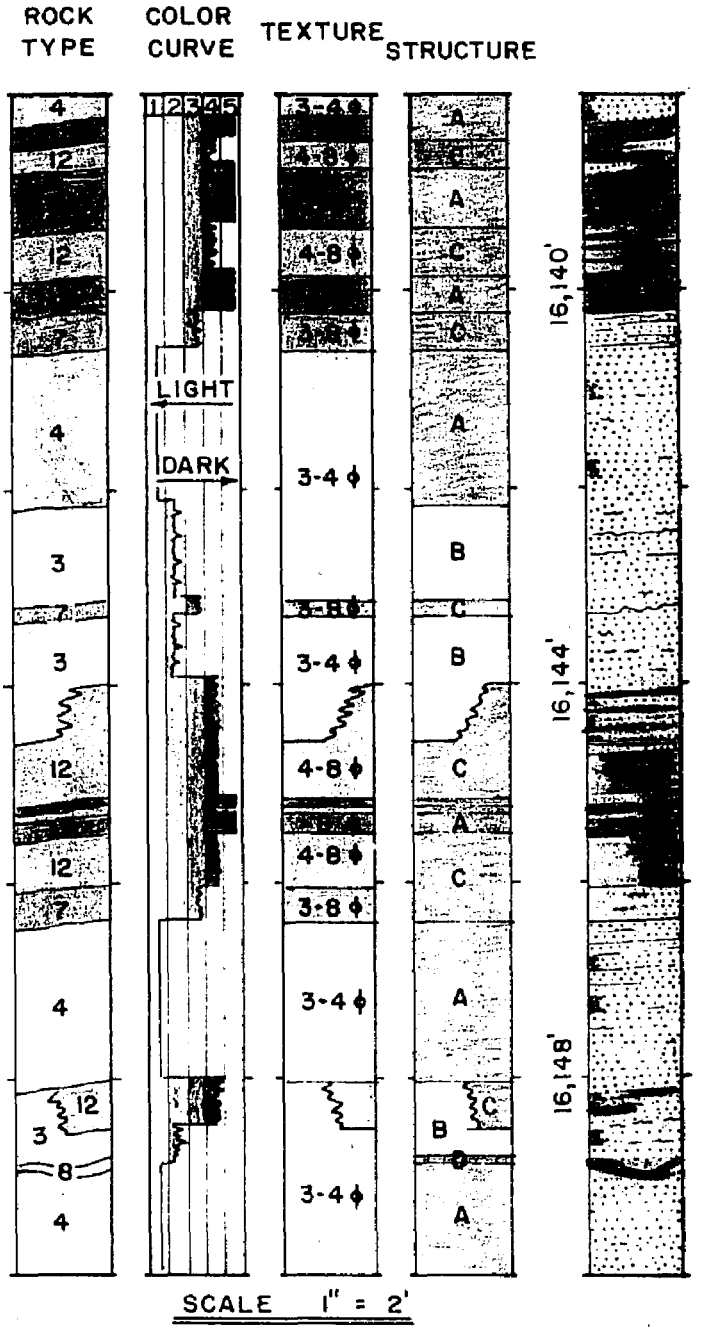
and angular. Other less common properties included accessory minerals, bonding materials, and hydrocarbon staining.

Core samples were classified according to sedimentary structures as massive, sub-massive, planar, random orientation of flakey carbonaceous matter, intercalation and color variegation, deformed or disrupted bedding, and reworking by organisms. Mineral classes recognized in thin section point counts were quartz, feldspar, mica, clay, and others.

For comparison of geologic columns, rock descriptions were plotted according to depth on log strips. Data from cuttings were plotted with one inch equal to 100 feet, beside color-coded lithologic columns (Fig. 6). Core data were plotted with one inch equal to two feet, with color-coded lithologic columns, and separate plots of rock type, color, grain-size, and sedimentary structure.

ROCK PROPERTY PLOTS

DESCRIPTIVE SAMPLE LOG



Shale, very dark gray-brown, somewhat brittle, resistant, non-calcareous, platy clay, with biotite. Sand intercalations.

Shale, as above, with carbonaceous flakes in partings. Banded with thin interbeds of medium gray, resistant siltstone.

Sandstone, light to medium gray, very fine to fine-grained, with carbonaceous laminae near top, massive below.

Sandstone grades to very fine and fine-grained, massive as above.

Sandstone as above, with large carbonaceous flakes and nodular partings.

Sandstone, as above.

Sandstone, thin-bedded with carbonaceous partings. Shale, very dark gray-brown, silty; carbonized leaves.

Sandstone, with dark gray-brown siltstone interbeds.
Siltstone, massive, very resistant

Siltstone grading to very fine-grained; dark gray-brown, resistant.
Sandstone, light to medium gray, very fine-grained, with laminations.
Sandstone, l.gr., very fine to fine-grained, massive, resistant.

Sandstone is mostly fine-grained; irregular, lenticular, lenticular shale partings with organic burrows.

Sandstone, as above, massive

Figure -6-

DESCRIPTIVE SAMPLE LOGS AND ROCK PROPERTIES

Exemplary Section: 16,138' to 16,150' continuous cored interval - Superior No.1. Petitjean.

CHAPTER IV

ANALYSIS

CLASSIFICATION OF SEDIMENTARY ROCKS

Thirteen different rock types were defined by megascropic examination of well cuttings (Fig. 3) and more exact descriptions of some rock types were made by microscopic examination of cores (Fig. 4). As sedimentary structures are not observable in cuttings, but are considered important in rock classification, a series of chi square tests were conducted. The object was to determine the degree of association of structure with grain size and properties upon which the classification of cuttings was based (See Appendix A and summary of results of Fig. 7).

These chi square tests showed that:

1) Massive and sub-massive rocks are sandstones and shales.
2) Planar structures occur in sandstones whereas random orientation of carbonaceous flakes, and intercalation and color variegation occur in dark-colored siltstones and mixed rocks.
3) Animal burrows, disrupted bedding, and pseudo-breccia occur in light-colored sandstones and mixed rocks.

In addition,

$X^2 = 32.08$
(Signif. at .01 level.)
4 d. f.

SEDIMENTARY STRUCTURE	COLOR: light	int.	dark	
Massive	49	7	8	64
Planar	17	18	15	50
Others	8	19	27	50
	74	40	50	164

SEDIMENTARY STRUCTURE - COLOR COMPARISON

$X^2 = 38.54$
(Signif. at .01 level)
4 d.f.

GRAIN SIZE	SEDIMENTARY STRUCTURE: Massive	Planar	Others	
Coarse Sand	35	15	16	66
Fine Sand	21	17	2	40
Silt, clay mixed	8	18	32	58
	64	50	50	164

GRAIN SIZE - SEDIMENTARY STRUCTURE COMPARISON

$X^2 = 141.04$
(Signif. at .01 level)
4 d.f.

COLOR	GRAIN SIZE: Coarse Sand	Fine Sand	Silt, clay mixed	
light	40	34	0	74
Intermed.	26	5	9	40
Dark	0	0	50	50
	66	39	59	164

COLOR - GRAIN SIZE COMPARISON

CHI SQUARE ANALYSIS OF RELATIONSHIPS BETWEEN ROCK PROPERTIES OF CONTINUOUS CORES - Figure -7-

4) Fine-grained rocks are dark-colored; coarse-grained rocks are light-colored.

In order to integrate thin-section mineral composition data into the classification, a regression analysis was conducted (Appendix A) comparing quartz percentage from thin-sections with variables of structure, color and grain size.

In this analysis, sedimentary structure was chosen as the independent variable and quartz percentage, percentage of fine to medium (1 to 3ϕ) grain-sizes, percentage of fine-grained (2 to 3ϕ) quartz, percentage of very fine (3 to 4ϕ) grain size, roundness of grains, and color of rock were considered as dependent variables. The mean and standard deviation for each variable, and simple correlation coefficients are shown in Fig. 8.

This regression analysis demonstrated two correlations between rock properties.

1) Coarse-grained rocks have a high percentage of quartz, rounded grains, light color, and massive and planar sedimentary structures.
2) Fine-grained rocks have a high percentage of mica and clay, angular grains, dark color, and structures other than massive and planar.

DIFFERENCES BETWEEN LITHOSOMES

Division of the prism of Neogene sediments into

VARIABLE	MEAN	STANDARD DEVIATION
A. Sedimentary structures (massive, planar and others)	5.00	2.00
B. % Quartz	53.75	13.70
C. % Coarse grains	64.52	13.18
D. % Fine grained quartz	22.75	16.67
E. % Very fine grained quartz	17.69	14.41
F. Roundness (round and angular)	50.12	11.72
G. Color (light, medium, and dark)	2.50	1.21

CORRELATION COEFFICIENTS

A : B = .90	C : D = -.53
A : C = .52	C : E = .39
A : D = .01	C : F = -.34
A : E = .96	C : G = .06
A : F = -.59	
A : G = .31	D : E = .19
	D : F = -.10
B : C = .67	D : G = .22
B : D = -.12	
B : E = .86	F : G = -.63
B : F = .66	
B : G = .23	

Figure -8-

MEANS, STANDARD DEVIATIONS, AND CORRELATION COEFFICIENTS FOR SEVEN THIN SECTION POINT COUNT VARIABLES.

lithosomes consisted of three steps. First, the graphic description of each well was examined and boundaries between lithosomes were defined on the following criteria:

1) The base of the chert gravel marks the boundary between the lithosomes I and II.
2) The top of the significant shell beds and lignites marks the boundary between lithosomes II and III.
3) The top of the massive, medium gray, blocky shale marks the boundary between lithosomes III and IV.
4) The top of the massive, very dark gray-brown, splintery shale marks the boundary between lithosomes IV and V.

The second step consisted of determining the sampling interval necessary to detect homogeneous lithologic units within each lithosome, i.e. test of interval homogeneity of lithosomes. For this test the 2600 to 4900 foot interval of the H.O.R., Caldwell Sugars No. 1 was used. The rock types occurring at the 1000, 500, 300, 100, and 50 foot intervals were chosen, and the occurrence of one or more rock types within these intervals was noted (Fig. 9). This sampling showed that even at the 50 foot interval, rock types are considerably heterogeneous. Thus, the 20 foot actual cutting recovery interval represents the most precise sampling.

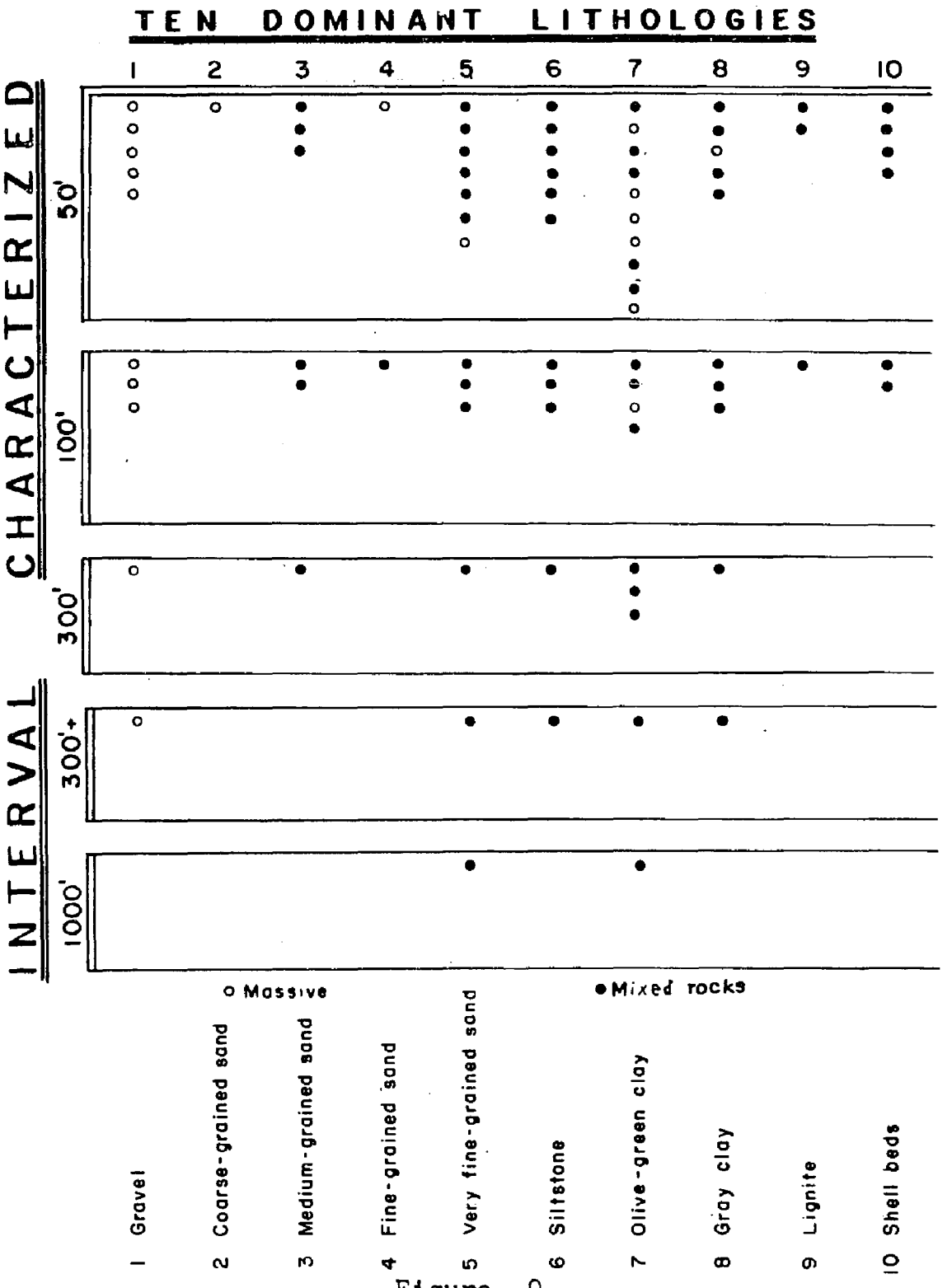


Figure -9-

INTERVAL CHARACTERIZATION PLOTS FOR TEN DOMINANT LITHOLOGIES

2600 to 4900 foot interval of well cuttings from Humble Oil and Refining Co, Caldwell Sugars No 1, Section 115, T14S-R15E, Lafourche Parish.

The final step entailed two tests of differences between lithosomes, concerned with lithologic homogeneity between geographically separated areas. In the first test, two widely spaced wells (H.O.R., Caldwell Sugars No. 1 and Texas Co., Vermilion Psh. School Board No. 1) were chosen and rock types occurring at 20 foot intervals were noted for each well. The results were set in the form of an analysis of variance table, modified for the chi square distribution (Fig. 10). This test showed that the variations within lithosomes due to geographic differences are much less than those arising from the lithosomes themselves. Thus, the lithosomes are recognizable over considerable geographic areas and are valid lithostratigraphic units.

A second test for lithologic homogeneity over geographic area was conducted, using data from the same wells but in this case only 20 randomly positioned sequences were selected from each lithosome. The results were substantially the same - greater differences between lithosomes than geographic variation within them, but less strikingly so. These results suggest that lithosomes are not only distinguishable over considerable geographic area, but that relatively few samples are needed to identify them. The results appear to contradict the initial tests which indicated the need for samples at 20 foot intervals, thus strongly suggesting that although

KINDS OF ROCKS	LITHOSOMES II * H.	II T.	III H.	III T.	IV H.	IV T.	V H.	V T.	
Coarse-grained	30	8	52	54	10	43	32	12	241
Fine-grained	40	23	90	60	27	86	54	32	412
Mixed	10	9	30	45	3	35	43	15	190
	80 \ 40 = 120		172 \ 159 = 331		40 \ 164 = 204		129 \ 59 = 188		843

Results:
Total (X^2 tot), 14 d.f. = 25.29 (Signif. at .05 level)
Between (X^2 rxc), 6 d.f. = 16.86 (Signif. at .01 level)
Within (X^2 w/rxc), 8 d.f. = 8.43 (Not signif.)
F = 1.87 (Signif. at .1 level)

POINT COUNT OF LITHOLOGIES CHARACTERIZING 20' INTERVALS - TOTAL CENSUS

KINDS OF ROCKS	LITHOSOMES II *H.	II T.	III H.	III T.	IV H.	IV T.	V H.	V T.	
Coarse-grained	11	11	4	6	7	8	2	3	52
Fine-grained	7	7	11	10	11	8	11	13	78
Mixed	2	2	5	4	2	4	7	4	30
	20 \ 20 = 40		20 \ 20 = 40		20 \ 20 = 40		20 \ 20 = 40		160

Results:
Total (X^2 tot), 14 d.f. = 27.20 (Signif. at .05 level)
Between (X^2 rxc), 6 d.f. = 14.40 (Signif. at .05 level)
Within (X^2 w/rxc), 8 d.f. = 12.80 (Not signif.)
F = 1.50 (Signif. at .2 level)

POINT COUNT OF LITHOLOGIES CHARACTERIZING 20 FOOT INTERVALS- 20 POINTS ONLY

* H. - Humble Oil & Refining Co., Caldwell Sugars No. 1
T. - Texas Co., Vermilion Psh. School Board No. 1

CHI SQUARE TESTS OF LITHOSOME SUBDIVISION - Figure -10-

the lithosomes include a somewhat heterogeneous aggregation of rock units on the order of 50 ≠ 50 feet thick, the gross lithosomic differences are greater than the magnitude of interval variation.

CHAPTER V

LITHOSTRATIGRAPHY

LITHOSOME I

Lithosome I is characterized by rounded pebbles and cobbles of dark gray, light gray, and buff chert and silicified oolite (Figs. 11 and 12). The pebbles occur in red-orange, medium to coarse-grained, loosely consolidated sands, whose color is imparted by ferruginous coating of grains. Gray and white sands and gray and variegated clays constitute most of the rest of the section. Carbonized plant remains and silicified wood are present.

The rock types occur in units of several hundred feet in thickness, with the maximum total thickness some 2000 feet. The areal distribution of these bodies, all with irregular bedding, is highly erratic and discontinuous (Fig. 13). These rocks produce high spontaneous potential and resistivity curves on electric logs (Fig. 14).

Sediments are interpreted as supralittoral, fluvial deposits because of the very coarse detritus, the abundance of terrigenous plant material, the iron oxide, and the absence of marine faunas (Fig. 15).

LITHOSOME II

Lithosome II is characterized by light olive-green, soft, smooth clays, light gray, bentonitic clays, light buff silts, and coarse, white to light buff sands

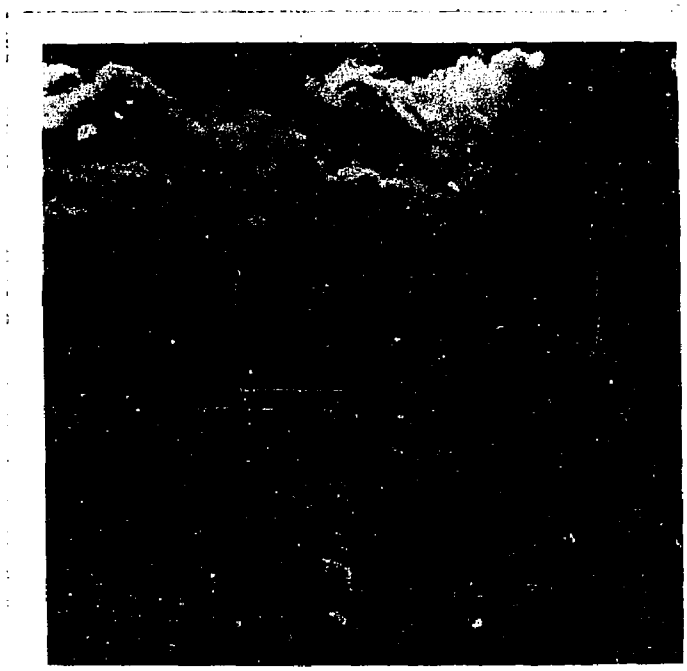


Figure 11 Chert gravel of the shallow subsurface where quarried from Plio-Pleistocene outcrops in eastern Vernon Parish.

Figure 12 Varicolored chert granules recovered in drill-bit cuttings from Lithosome I(X5).

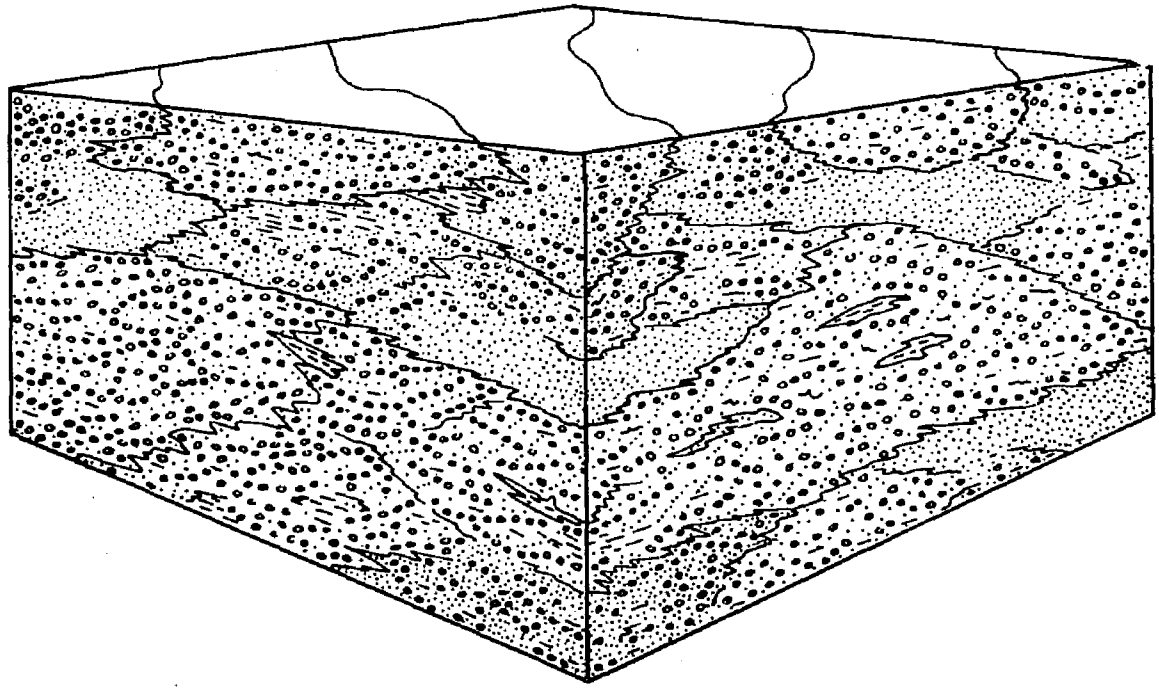


Figure -13-

BLOCK DIAGRAM MODEL OF SEDIMENTARY PATTERN

LITHOSOME -I-

HUMBLE OIL & REFINING COMPANY

CALDWELL SUGARS No. I.
Sec. 115, T 14 S - R 15 E
LAFOURCHE PARISH

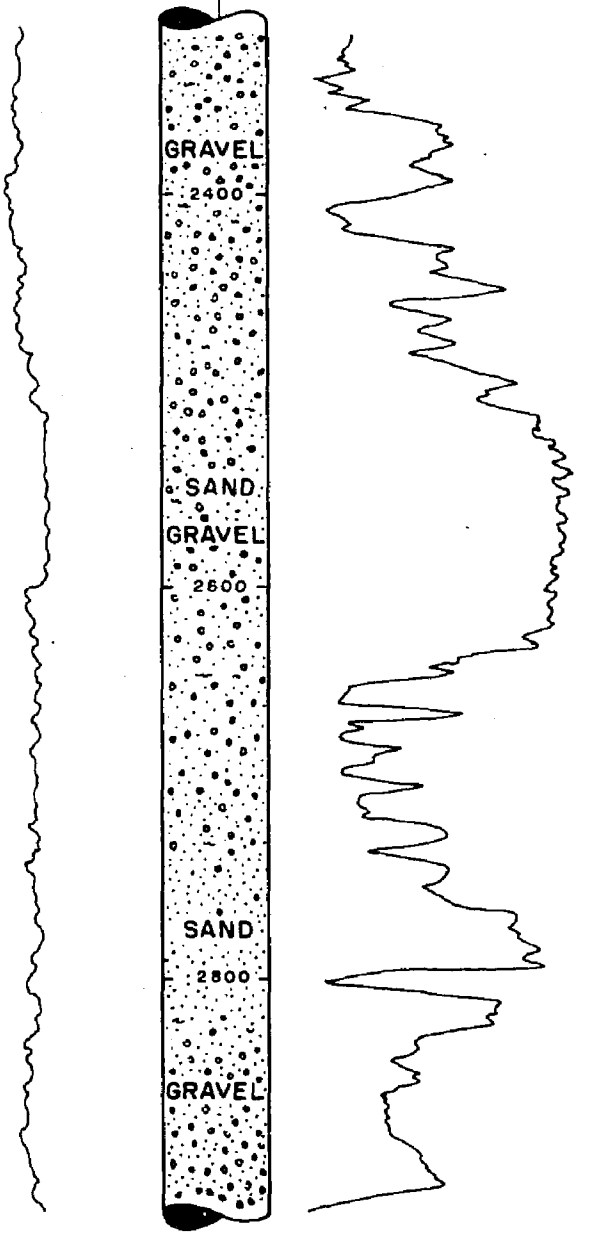


Figure -14-

TYPICAL ELECTRICAL AND INTERPRETIVE LOG OF LITHOSOME I

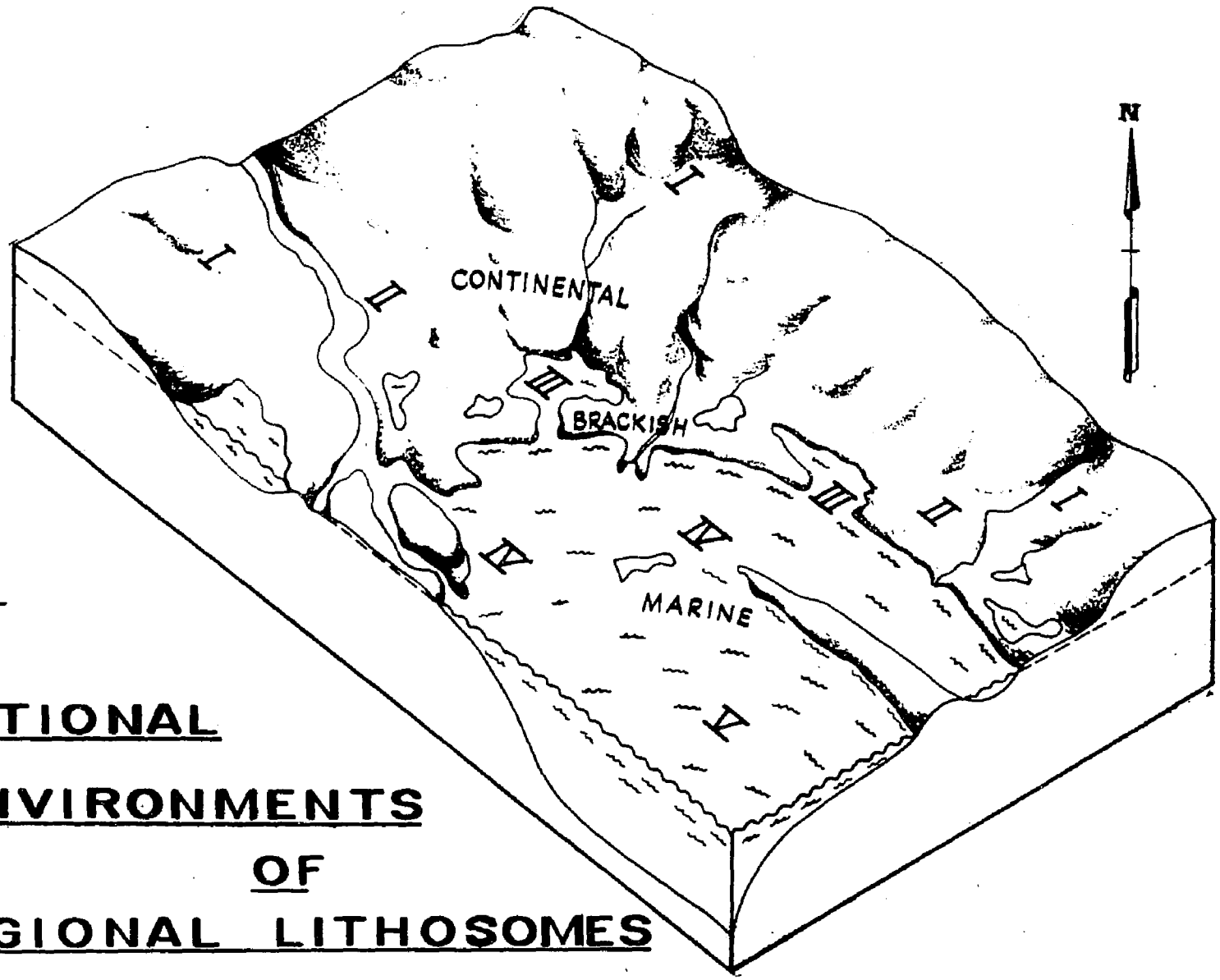


Figure -15-

DEPOSITIONAL ENVIRONMENTS OF REGIONAL LITHOSOMES

SOUTH LOUISIANA SUBSURFACE TERTIARY

(Figs. 16 to 19). Flakes and fragments of carbonized wood are present, as are lenses of red-brown clay, and rather rarely, molluscan shells.

Sedimentary units are ordinarily from 100 to 300 feet thick; the maximum total thickness is 3000 feet (Fig. 20). Electric log curves record high spontaneous potential of sands in contrast to low, clay-silt values (Fig. 21).

Sediments are considered to be fluvial deposits of littoral environs because of abundant plant material, characteristic thick, coarse sands, and paucity of marine faunas (Fig. 15).

LITHOSOME III

Lithosome III is characterized by shell beds and lignites, interbedded with sands ranging widely in grain size, and light olive and light gray clays (Figs. 22 and 23). Shells are mostly robust pelecypods, with fewer gastropods, and still fewer echinoids, barnacles, and bryozoans. Shell beds are sometimes cemented into shell marl or chalky coquina. The lignites are usually dark brown, soft, earthy and fibrous, but sometimes grade to black, glossy, brittle, sub-bituminous coal. They occur in seams and thin, lenticular beds. Root zones of medium gray, carbonaceous clay, limonitic concentrations, and bentonites are present. Medium gray,

Figure 16 Soft, easily dissolved cuttings of light olive-gray clay from Lithosome II (X5).

Figure 17 Cuttings of light olive-gray, fine silt typical of Lithosome II (X5).

Figure 18 Cuttings of massive, coarse-grained, poorly consolidated sand of Lithosome II (X5).

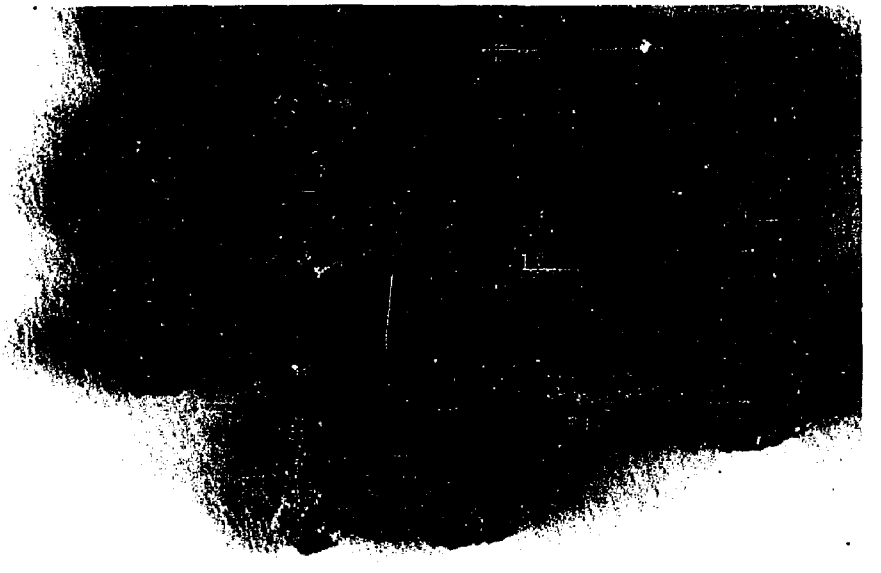


Figure 19 Cuttings of fine to medium-grained sand from Lithosome II (X5).

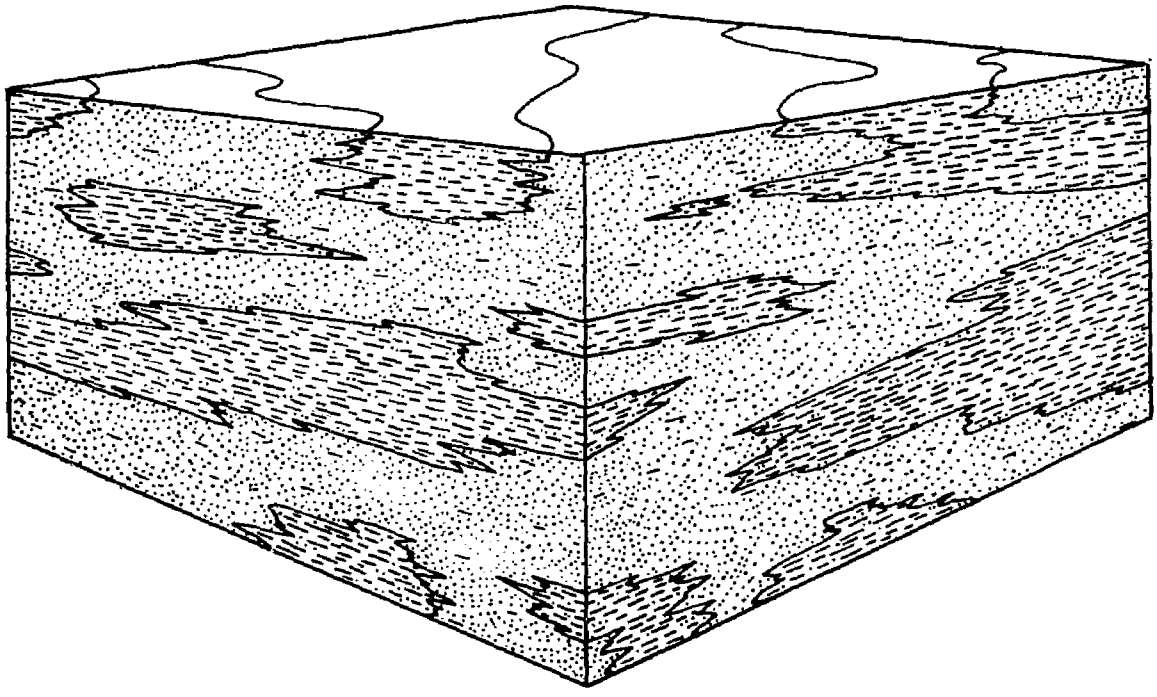


Figure -20-

BLOCK DIAGRAM MODEL OF SEDIMENTARY PATTERN

LITHOSOME -II-

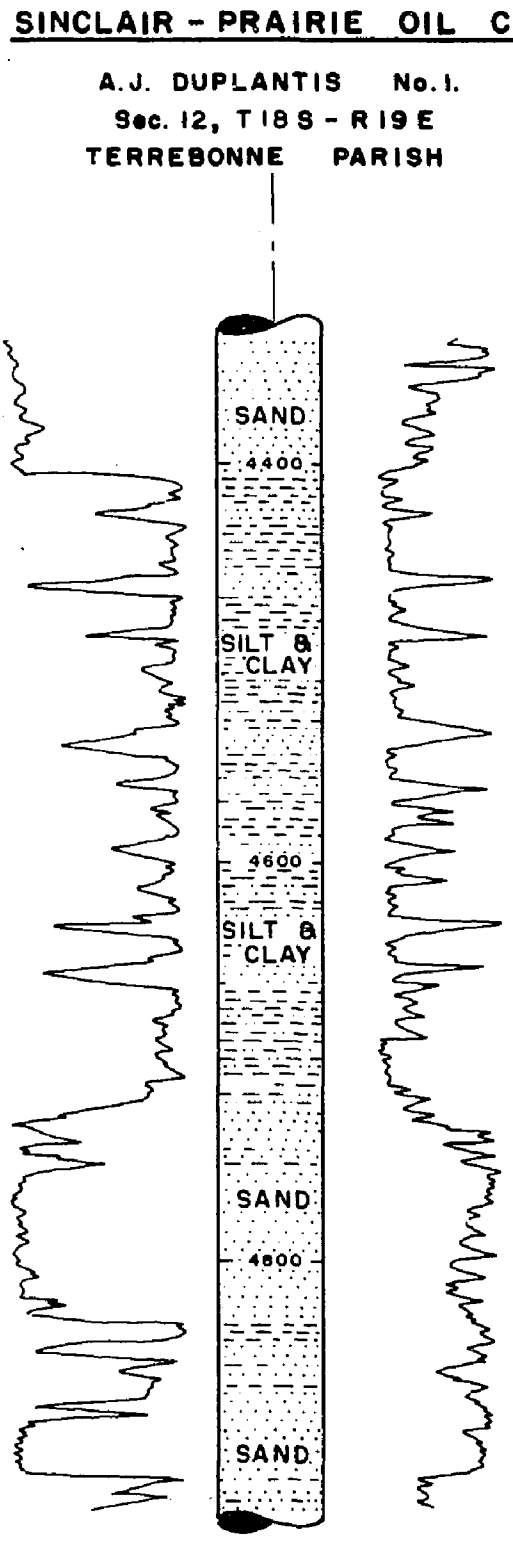


Figure -21-

TYPICAL ELECTRICAL AND INTERPRETIVE LOG OF LITHOSOME II

Figure 22 Shells from accumulations in Lithosome lll, fragmented in cuttings (X5).

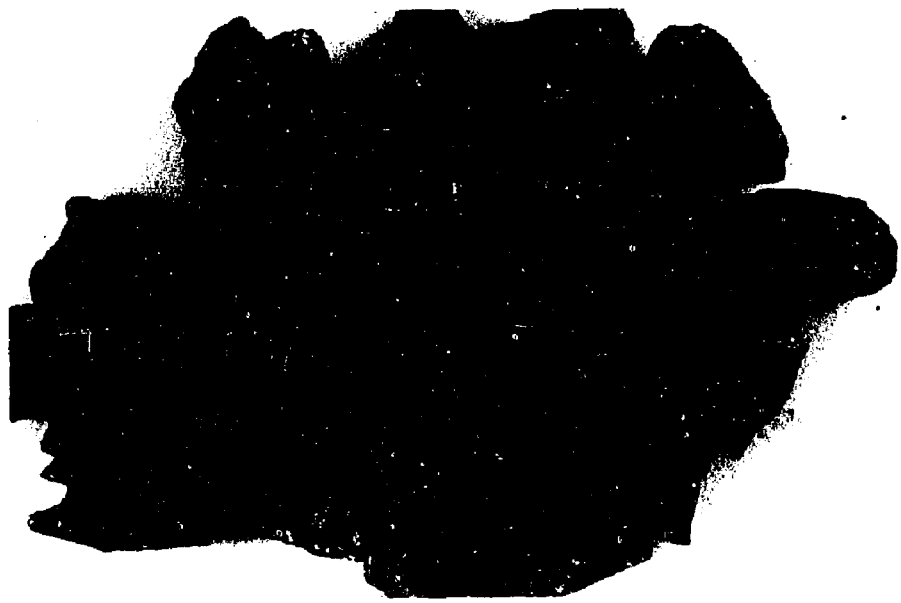


Figure 23 Cuttings of very dark brown, lignitic coal, representative of Lithosome III (X5).

blocky shales commonly intertongue.

The sedimentary units average 50 feet in thickness; the total interval averages about 2500 feet (Fig.24). The marls and shell beds produce broken, high spontaneous potential curves in contrast to uniform sand readings and low shale values (Fig. 25).

Sediments are considered to be shallow neritic, littoral, and paludal deposits because of the molluscan shell beds, lignites and coals, and arenaceous foraminifera (Fig. 15).

LITHOSOME IV

Lithosome IV is characterized by massive, smooth, uniform, blocky to platy, medium gray shale (Fig. 26). Medium gray-brown siltstones are common interbeds, and thin, very fine to medium-grained, well-indurated sandstones are present (Fig. 27).

The shales occur in 300 to 500 foot intervals; the total thickness of the lithosome is about 2500 feet (Fig. 28). Electric log spontaneous potential and resistivity curves show the thick intervals of low shale value, broken by high sand readings (Fig. 29).

Deposits are considered to be shallow to middle neritic because of the massive shale with little sand or plant material, and because of enclosed calcareous foraminifera (Fig. 15).

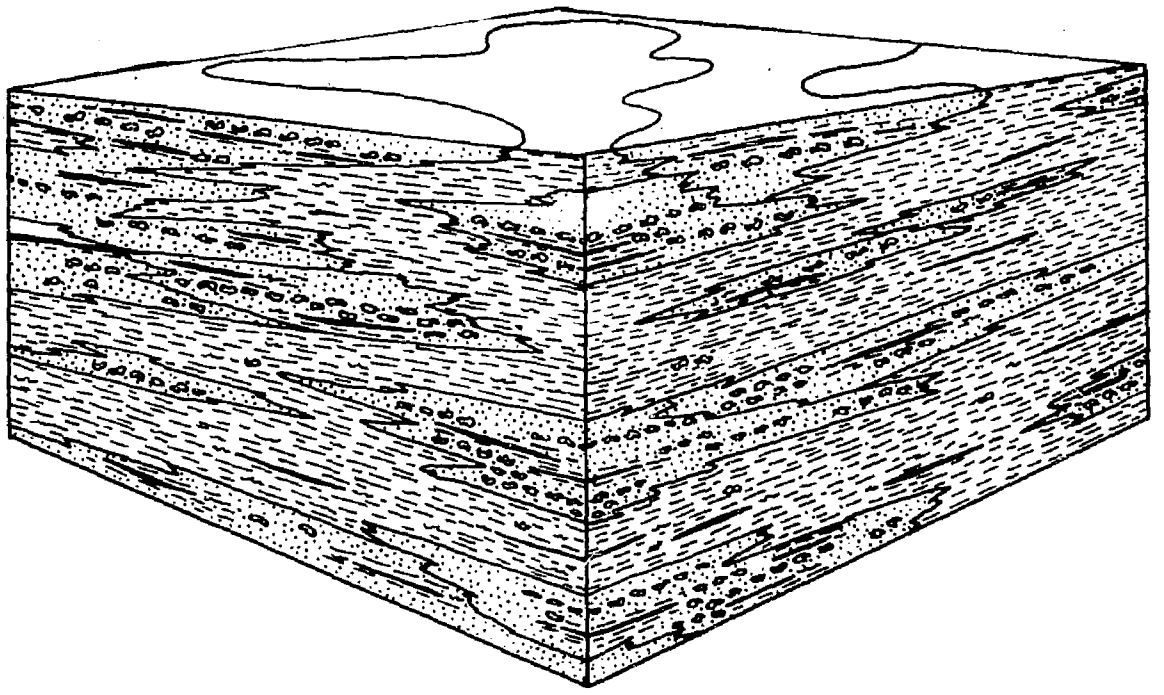


Figure -24-

BLOCK DIAGRAM MODEL OF SEDIMENTARY PATTERN

LITHOSOME -III-

SINCLAIR - PRAIRIE OIL CO.

A.J. DUPLANTIS No. 1.
Sec. 12, T 18 S - R 19 E
TERREBONNE PARISH

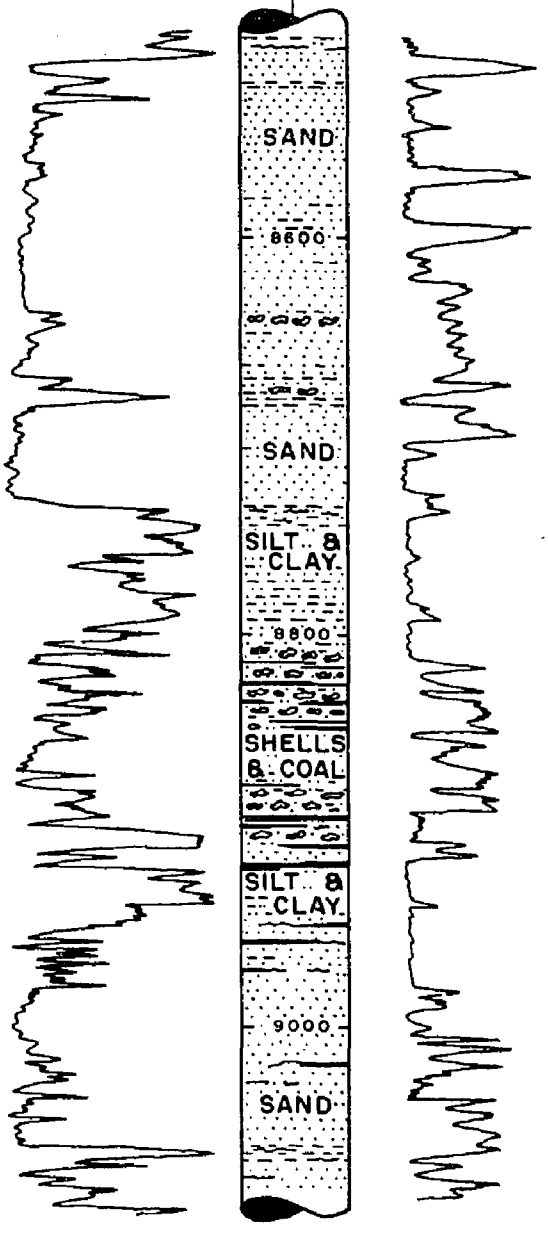


Figure -25-

TYPICAL ELECTRICAL AND INTERPRETIVE LOG OF LITHOSOME III

Figure 26 Cuttings of massive, medium gray, blocky to platy shale, typical of Lithosome IV (X5)

Figure 27 Cuttings of very fine-grained, consolidated sandstone from Lithosome IV (X5).

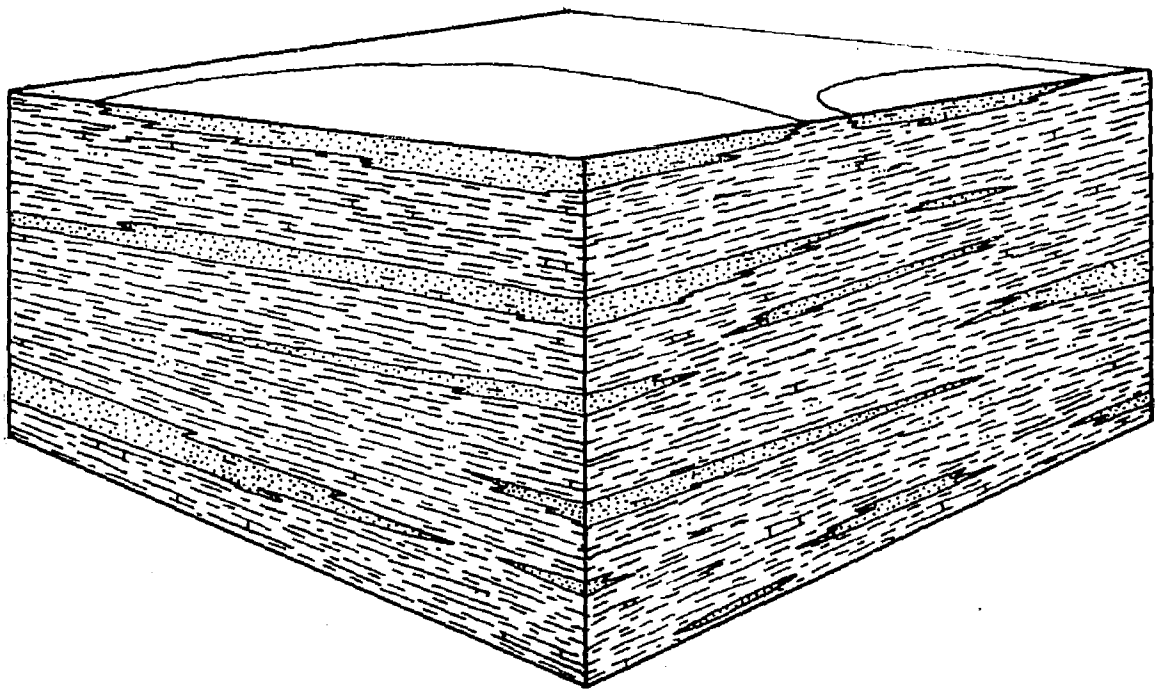


Figure -28-

BLOCK DIAGRAM MODEL OF SEDIMENTARY PATTERN

LITHOSOME -IV-

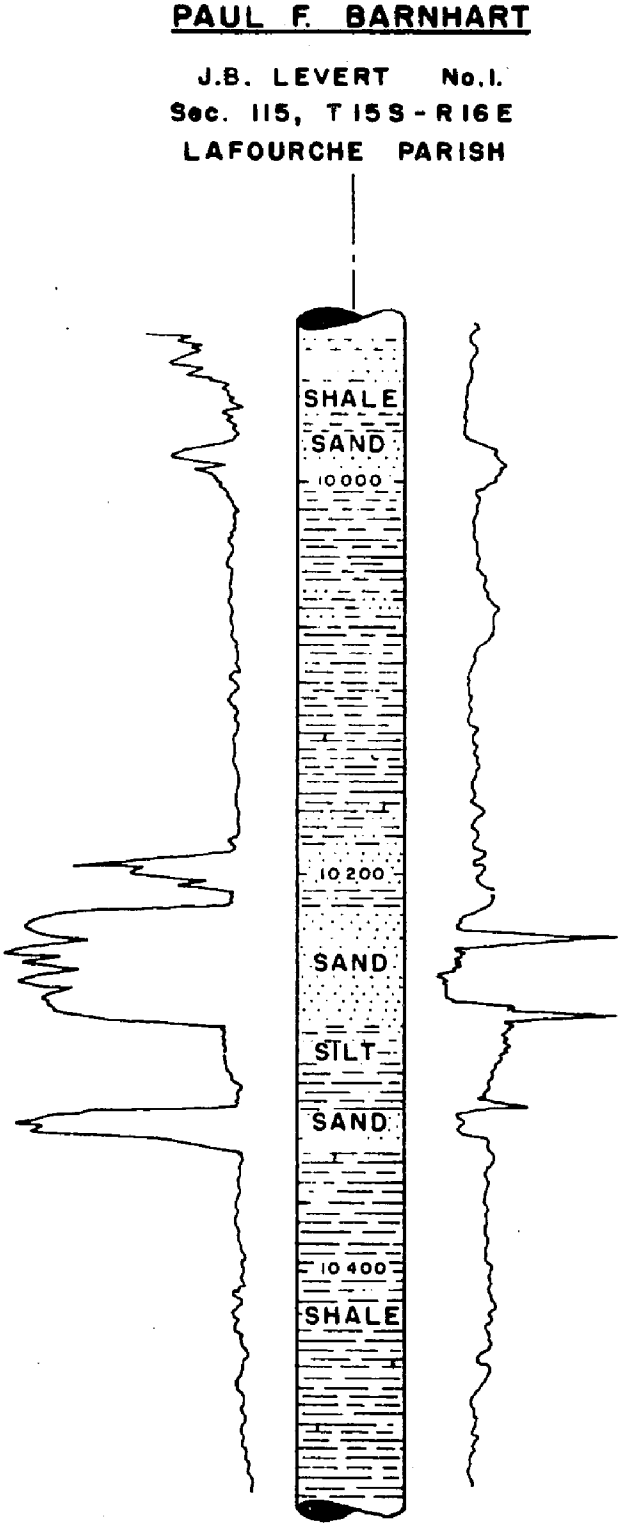


Figure -29-

TYPICAL ELECTRICAL AND INTERPRETIVE LOG OF LITHOSOME IV

LITHOSOME V

Lithosome V is characterized by very dark gray-brown, brittle, somewhat resistant, tabular to splintery, calcareous clay shale (Fig. 30). Stringers of gray, fine to very fine-grained sandstone and medium gray-brown siltstone are present (Fig. 31). Local thick development of these interbeds has been observed.

The shale is ordinarily massive and inpenetrable (Fig. 32), with electric log curves recording low spontaneous potential and resistivity (Fig. 33).

Sediments are considered to have been deposited in outer neritic and shallow bathyal regions of the continent's outer shelf and slope because of continuous deposition of fine sediment with enclosed deep water fauna (Fig. 15).

Local concentration of sandstone and siltstone is attributed to deltaic progradation to the shelf edge with gravity slide movement of partially lithified sediment down slippery shale slide planes (Fig. 34). The occurrence in the deep water shales, of cross-bedded sands, carbonized leaves, clay chips, intercalated rocks, inclined and variable bedding attitudes and disrupted bedding, and soft sediment flowage structures are all evidence of this redeposition (Figs. 35 to 39).

Figure 30 Cuttings of very dark gray-brown, splintery shale which occurs in great thickness in Lithosome V (X5).

Figure 31 Cuttings of medium to dark gray-brown coarse-grained siltstone, characteristic of Lithosome V (X5).

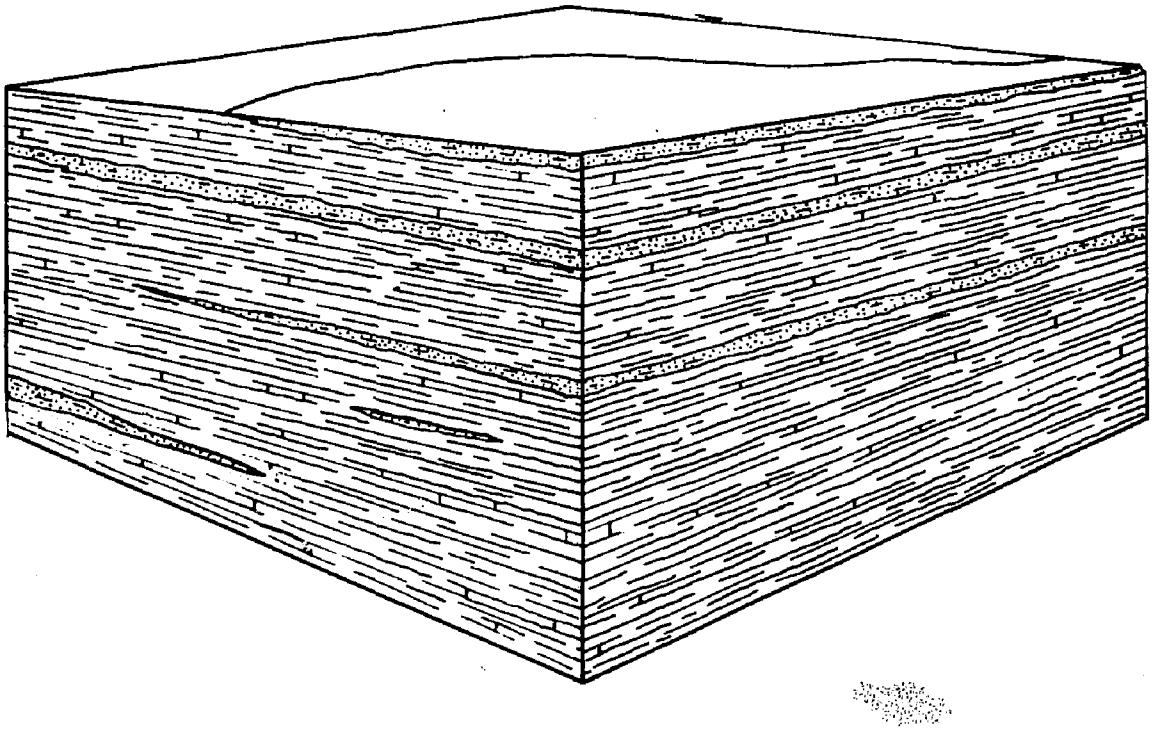


Figure -32-

BLOCK DIAGRAM MODEL
OF
SEDIMENTARY PATTERN

LITHOSOME -V-

CALIFORNIA COMPANY

W.R. TIMKEN No.5.
Sec. 35, T14S - R 22 E
ST. CHARLES PARISH

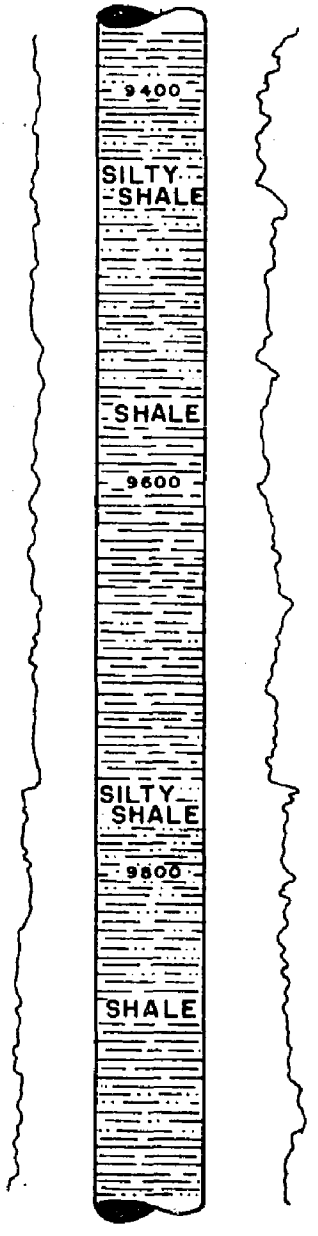


Figure -33-

TYPICAL ELECTRICAL AND INTERPRETIVE LOG OF LITHOSOME V

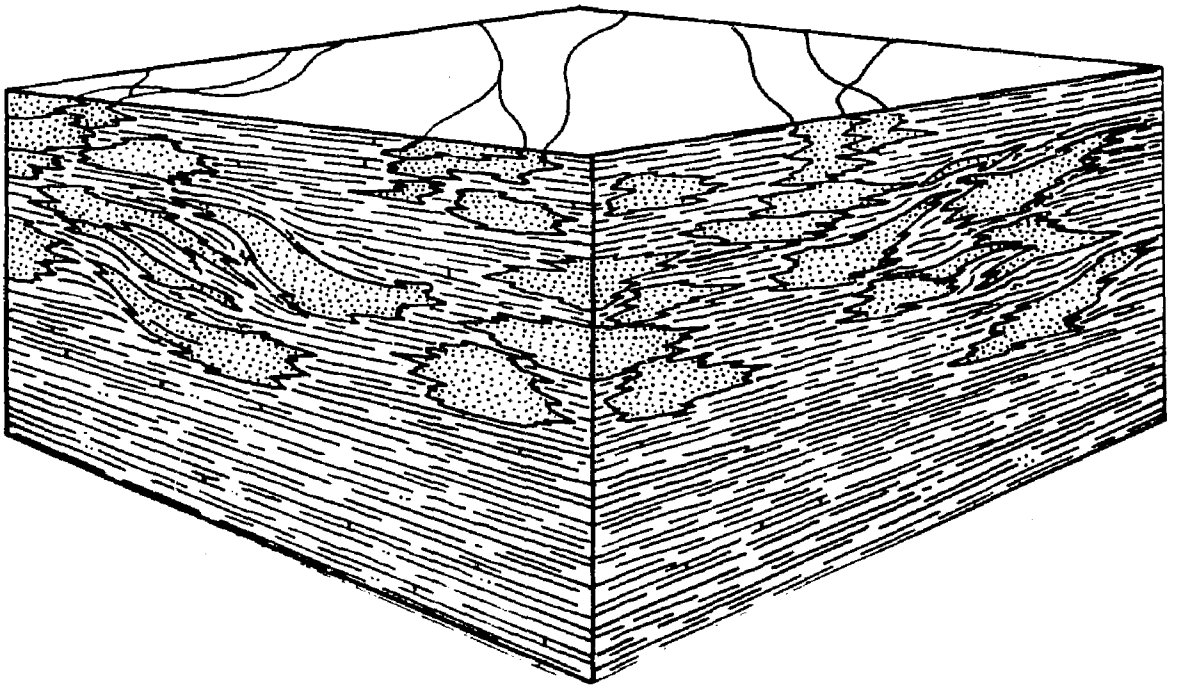


Figure -34-

BLOCK DIAGRAM MODEL OF SEDIMENTARY PATTERN

LITHOSOME -V-

DELTAIC PHASE

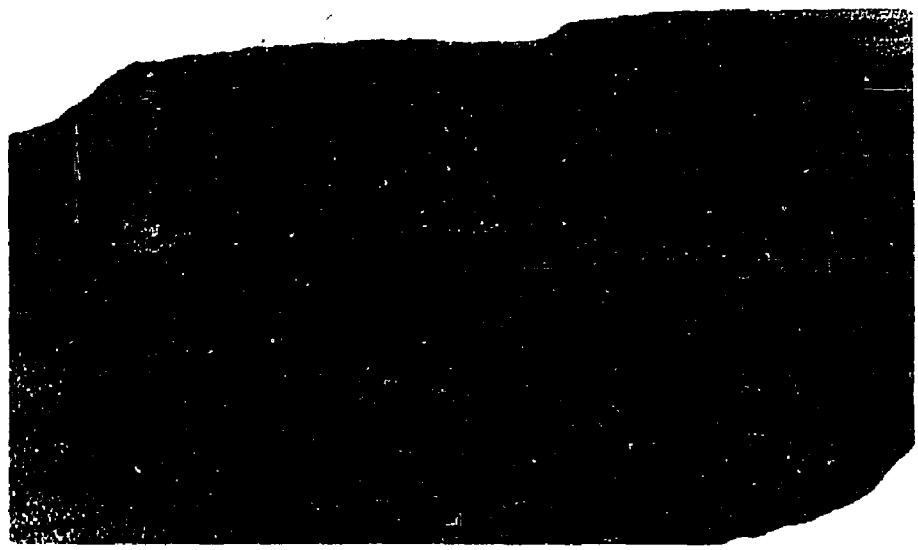


Figure 35 Overturned cross-bedding in very fine-grained sandstone polished section (X1.5)

Figure 36 Bedding plane parting in a core with carbonized leaves in fine-grained sandstone (X1.5)

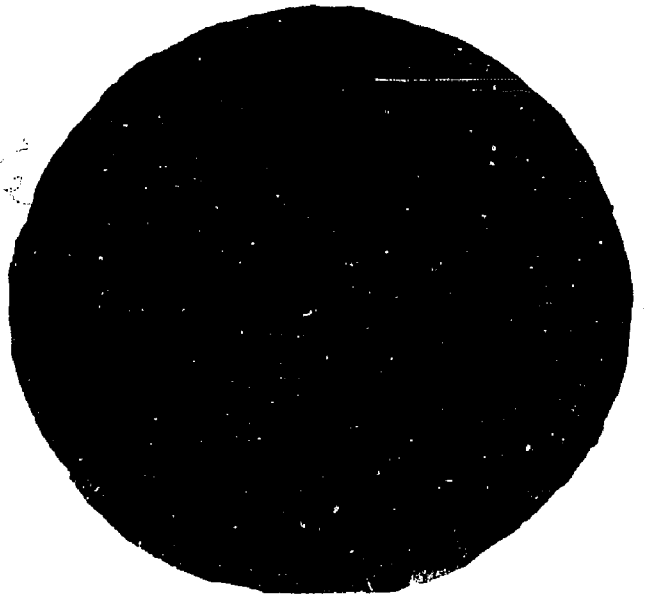


Figure 37 Bedding plane parting in a core with clay chips in very fine-grained sandstone (X1.5)

Figure 38 Pseudo-breccia of disrupted shale seams in fine-grained sandstone polished section (X1.5)

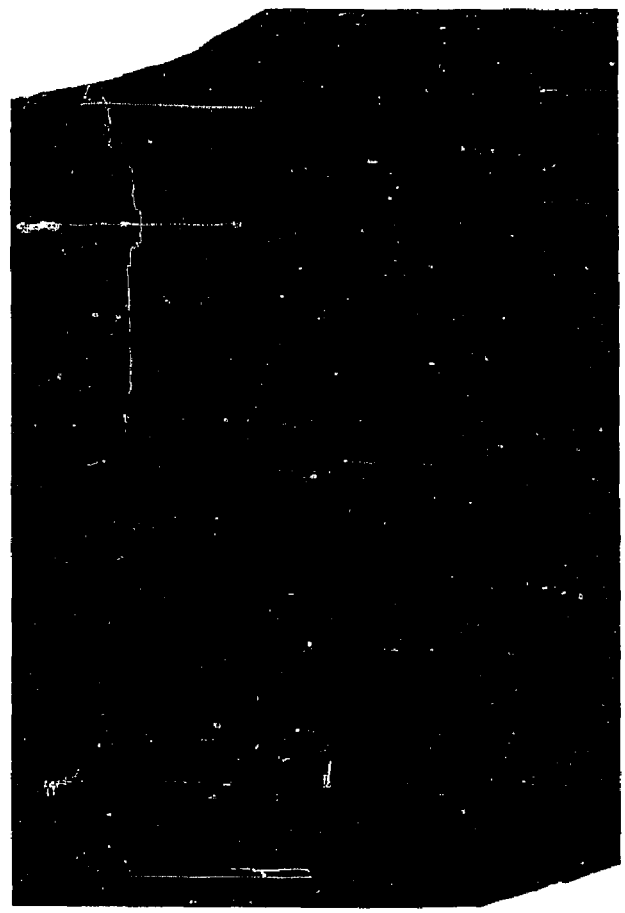


Figure 39 Polished section showing flowage of soft sediment which has forced light gray, very fine-grained sandstone into medium gray siltstone with disruption of bedding and crumpling of carbonaceous laminae (X1.5)

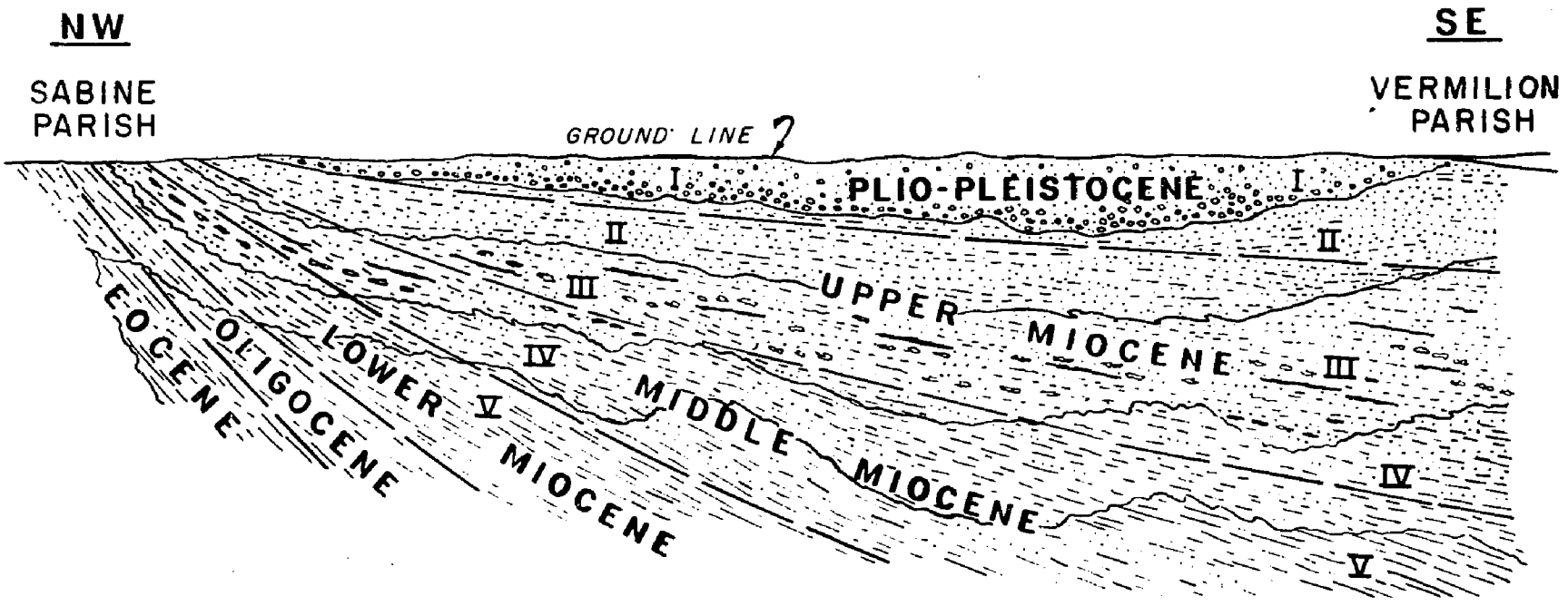
CHAPTER VI

SUMMARY AND CONCLUSIONS

The subsurface Neogene rocks of south Louisiana have been divided into five lithosomes on the basis of rock data (Fig. 40). These data are from well cuttings and cores which were described and plotted as color-coded lithologic logs. Five lithosomes are recognized by the first or last occurrence of certain diagnostic rock types of the thirteen different types defined from cuttings. This subdivision was validated by chi square analysis, as it was found that more variation was introduced by stratigraphy than geography. It was also demonstrated that the validity of the subdivision could be tested with relatively few samples.

Subdivision of the prism of sediments permits the more precise location of the position of rocks in well sections, and recognition of juxtaposed rocks. This knowledge of the distribution of the rock types facilitates a more refined classification of the depositional environments and patterns of the sediments.

It is believed that the localization of hydrocarbons can be predicted more accurately with use of these results of analysis of rock data. Petroleum reserves should not be anticipated in lithosomes I and II because of the unfavorable, continental aspects of the depositional environments, and the resulting preponderance



SOUTH LOUISIANA

Figure -40-

GENERALIZED GEOLOGIC CROSS-SECTION SABINE PARISH TO TERREBONNE PARISH

Showing distribution of regional lithosomes in time and space.

HORIZONTAL SCALE: 1"= 25 MILES VERTICAL SCALE : 1" = 5,000 FEET.

of coarse terrigenous detritus. Large reserves can be expected where sands of lithosome III occur on salt domes or other large structures. Considerable closure is necessary for entrapment and retention of fluids in such thick reservoirs. In lithosome IV, however, petroleum would be trapped in thin sandstones on even the most subtle structures, and in stratigraphic sand pinch-out traps. Reservoir sands are less likely to be developed in lithosome V, but prospects are excellent wherever deltaic conditions concentrate marine organisms and erratic sandstones.

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APPENDIX A

Statistical Notation

APPENDIX A

(1) Chi Square, two by two (2 x 2) Notation:

$$X^2 = \frac{(1^{n}1 \times 2^{n}2 - 1^{n}2 \times 2^{n}1)^2}{1^{n}. \times 2^{n} . \times .^{n}1x .^{n}2}$$

(2) Chi Square, row by column (r x c) Notation:

Total Variance:

$$X^2_{tot} = N\left[\sum_{i=1}^{c} \frac{(i^{n}1/1)^2}{i^{n}./.} \Big/ \frac{.^{n}1/1}{} + \cdots \sum_{i=1}^{c} \frac{(i^{n}r/s)^2}{i^{n}./.} \Big/ \frac{}{.^{n}r/.} - 1\right]$$

Variance between:

$$X^2_{rxc} = N\left[\sum_{i=1}^{c} \frac{(i^{n}1/.)^2}{i^{n}./.} \Big/ \frac{}{.^{n}1/.} + \cdots + \sum_{i=1}^{c} \frac{(i^{n}r/.)^2}{i^{n}./.} \Big/ \frac{}{.^{n}r/.} - 1\right]$$

Variance within:

$$X^2_{w/rxc} = X^2_{tot} - X^2_{rxc}$$

(3) F- ratio Significance Test Notation:

$$\frac{\text{Variance between}}{\text{Variance within}} = \frac{\frac{X^2_{rxc}}{d.f.}}{\frac{X^2_{w/rxc}}{d.f.}}$$

(d.f. = number of degrees of freedom)

(4) Computation of Variance Notation:

Standard Error of Estimate ($S_{x.y}$) = $\frac{\Sigma(y-yx)^2}{n-2}$

(x and y are variables; n = number of values)

Population Variance (σ^2) = $\frac{\Sigma(x-\bar{x})^2}{n-n}$

(5) Computation of Correlation Coefficients of x and y:

Correlation Coefficient (r) = $\frac{\Sigma(x-\bar{x})\ (y-\bar{y})}{\sqrt{\Sigma(x-\bar{x})^2(y-\bar{y})^2}}$

APPENDIX B

Descriptions of Well Cuttings

APPENDIX B

Descriptions of Well Cuttings

Location of wells are shown in Figure 58. The following symbols are used in construction of interpretive logs of well cuttings:

Conglomerate - yellow with ink circle for quartz, triangles for detrital chert.

Sand or sandstone - yellow with ink dots.

Limestone - blue.

Marl - blue and yellow.

Shells - blue dashes.

Coal - black ink lines.

Anhydrite or gypsum - purple with ink hatchers.

Silt or siltstone - gold ochre.

Shale or clay - actual color of rock.

Variegated shale or clay - actual colors variegated.

Intercalated rocks - colors, as above, intercalated.

Mineral inclusions - various ink symbols.

INDUSTRIAL LUMBER COMPANY
HUMBLE OIL & REFINING COMPANY NO. 1

Section 21 - T3S, R5E, Allen Parish (Well No. 3)

Sample Interval: 0' - 5040'

0' Sands, red-orange, fine to medium-grained, fairly well-sorted, sub-angular to sub-round, ferruginous, unconsolidated.

40' Some dark chert grains.

60' Some black, carbonized wood fragments.

120' Gravel of granules and pebbles of varicolored chert and quartz in orange-buff matrix.

170' Sand, white or light gray, fine-grained and very coarse-grained, sub-angular to sub-round, in part frosted.

200' Samples missing.

560' Sandstone, white or light gray, fine-grained and very coarse-grained, sub-angular to sub-round, in part consolidated, very porous; clear, quartz grains.

620' Some interstitial silt.

720' Clay, very light olive-gray, soft, bentonitic.

740' Sandstone is better indurated, with silty-argillaceous matrix.

770' Clay, as above, silty.

800' Some light brown and yellow clay.

860' Siltstone to very fine-grained sandstone, as above, with small medium-grained fraction. Some light olive-gray clay, and ashy, argillaceous matrix.

920' Clay, very light gray-brown, soft, smooth.

950' Siltstone to very fine-grained sandstone, as above.

980' Sandstone, light buff, very fine to fine-grained, sub-round, very silty.

1060' Sand, white, very fine to fine-grained, with small medium-grained fraction, sub-angular to round, unconsolidated, very porous; clear quartz grains.

1120' Samples missing.

1220' Sand, as above.

1240' Clay, very light gray to olive-buff, soft, smooth.

1280' Sand, light buff, very fine to fine-grained, fairly well-sorted, sub-angular to sub-round unconsolidated.

1310' Sand, as above, silty, ashy.

1360' Clay, very light gray, smooth, bentonitic.

1410' Sand, light buff, very fine to fine-grained, with small medium-grained fraction, unconsolidated; clay lentles.

1440' Sandstone is somewhat consolidated.

1500' Pelecypod shell fragments in sandstone.

1620' Clay, very light gray with some maroon mottling, smooth; thin interbeds in sandstone.

1700' Pelecypod shell beds and marly sandstone.

1800' Sandstone is better consolidated.

1840' Sandstone assumes a few dark chert grains.

1880' Siltstone, light buff, arenaceous.

1920' Sandstone as above, with small coarse-grained fraction.

1940' Pebbles and granules of white to light buff limestone; rounded.

2000' (Sidewall core) Clay, light gray, soft, smooth, blocky, with carbonized wood fragments.

2050' Siltstone, light buff and sandstone, as above.

2080' Clay, olive-brown, very light gray, in part silty.

2120' Clay, light gray to light maroon, calcareous, mottled, smooth, blocky.

2140' Some very light gray siltstone.

2210' Sand, light gray, fine to medium-grained, sub-angular to round, very porous; clear quartz grains.

2240' Clay, light gray, maroon-mottled, soft smooth, blocky.

2280' (Sidewall core) Siltstone to very fine-grained sandstone, light gray-buff, friable.

2350' (Sidewall core) Sand, light buff, fine to medium-grained, poorly consolidated, sub-angular to sub-round.

2390' Clay, dark gray, carbonaceous.

2400' Interbedded clay and sand as above.

2420' (Sidewall core) Sand, light gray or white, very fine-grained, sub-angular, unconsolidated, well-sorted.

2450' Clay, light gray, maroon-mottled, blocky.

2530' Sand, light gray, fine to medium-grained, unconsolidated, angular to sub-round.

2560' Sand assumes coarse fraction.

2570' (Sidewall core) Intercalations of shale, medium gray, platy to tabular.

2610' Sand is very argillaceous.

2740' Sand assumes silty admixture.

2760' Sand, light gray, fine to medium-grained, poorly-sorted, sub-angular to sub-round, unconsol. very porous.

2800' (Sidewall core) Sand as above, loosely consol. clay, dark red-brown.

2810' Samples missing.

2860' (Sidewall core) Clay, light gray, light maroon-mottled, silty.

2980' Sand assumes coarse-grained fraction.

3000' Shale, light gray, maroon-mottled, in part platy to tabular, fissile; soft clay.

3090' Clay, light gray, blocky, smooth, soft, uniform; calcareous in zones.

3130' (Sidewall core) Sandstone, very light gray, very fine-grained, well-sorted, loosely consolidated.

3160' Clay, as above, maroon-mottled.

3200' (Sidewall core) Intercalated clay and very fine-grained sandstone, as above.

3240' Shale, very dark gray, carbonaceous, with black coal seams. Some carbonaceous siltstone.

3270' (Sidewall core) Shale, medium-gray, very fossiliferous, with white calcareous bodies and black carbonaceous seams.

3300' Oyster beds with silty, arenaceous matrix.

3310' (Sidewall core) Siltstone, light buff, with very fine sand admixture.

3370' (Sidewall core) Siltstone, as above.

3430' (Sidewall core) Clay and siltstone, light gray or gray-buff.

3480' (Sidewall core) Siltstone and clay, as above, pockets of very fine sand.

3500' Sand, light gray or white, medium-grained with coarse fraction, sub-round, not well-sorted, unconsolidated but with interstitial silt.

3520' (Sidewall core) Sand, as above, loosely consol.

3570' (Sidewall core) Clay, light olive-gray, smooth, uniform, interbedded in sandstone.

3600' (Sidewall core) Sandstone, light buff, very fine-grained, silty.

3620' Coquina of shells and shell fragments; mostly pelecypods and gastropods.

3650' (Sidewall core) Clay, olive-gray, as above.

3690' (Sidewall core) Clay, as above, with white calcareous bodies (relict shells)

3730' (Sidewall core) Clay, as above, with fine-grained sandstone and marl intercalations.

3770' (Sidewall core) Sandstone, olive-gray, very fine to fine-grained, argillaceous.

3830' (Sidewall core) Siltstone, light buff.

3880' Sandstone, medium gray, fine-grained, silty, fairly well consolidated.

3900' Clay, light olive-gray, as above.

3960' Sandstone, as above.

4000' (Sidewall core) Sandstone, light olive-gray, very fine to fine-grained, as above.

4070' (Sidewall core) Sandstone, as above, interbedded with clay.

4150' (Sidewall core) Clay and Siltstone, light olive-gray.

4220' (Sidewall core) Siltstone, as above.

4240' Clay, very light gray, bentonitic; platy to tabular, smooth, uniform.

4280' (Sidewall core) Sandstone, light olive-gray, very fine to fine-grained, argillaceous, ashy.

4310' (Sidewall core) Sandstone, light gray, fine-grained, with medium-grained fraction, sub-round to round, very argillaceous, ashy,.

4350' (Sidewall core) Sandstone, as above.

4370' (Sidewall core) Sandstone, as above, with some very coarse sand.

4420' (Sidewall core) Shale, light olive-green, soft, smooth, non-calcareous, fissile.

4450' (Sidewall core) Sandstone, as above.

4520' (Sidewall core) Clay and sandstone, as above.

4620' (Sidewall core) Clay as above, with silty zones.

4620' (Sidewall core) Siltstone and very fine-grained sandstone, light olive-green, very argillaceous, silty.

4690' (Sidewall core) Siltstone and very fine-grained sandstone, as above.

4800' (Sidewall core) Sand and sandstone, light olive-green, very fine-grained, silty , argillaceous.

4830' (Sidewall core) Sandstone and shale, as above.

4860' Shale, medium olive-green, smooth, non-calcareous, clay.

4920' (Sidewall core) Shale and fine-grained sandstone.

4960' (Sidewall core) Sandstone and siltstone, as above.

4990' (Sidewall core) Shale, as above.

Sample Total Depth: 5040'

This updip well penetrates only three lithosomes. Most of the coarse sediment of lithosome I is missing, but the upper 200 feet of cuttings are present. Samples resume at 560' in massive sands of lithosome II, and the top of lithosome III is picked at the top of coal and shell-rich beds at 3240'.

STANOLIND OIL AND GAS COMPANY
DUGAS AND LEBLANC NO. 1

Section 55 - T12S, R13E, Assumption Parish
(Well No. 4)
Sample Interval: 5,050' to 10,903'

5050' Pebble conglomerate with rounded quartz and varicolored chert in matrix of unsorted, unconsolidated sand.

5140' Siltstone, light olive-green.

5170' Sand, very coarse, with pebbles, as above.

5260' Sand, light gray, medium and coarse-grained, very poorly-sorted, angular to sub-angular.

5320' Clay, red-brown, and siltstone, light olive-gray.

5420' Few shells of robust pelecypods.

5520' Clay and siltstone, light olive-gray.

5730' Clay, red-brown, variegated.

5950' Sandstone, light gray, medium to coarse-grained, fairly well-sorted, uniform, massive, sub-angular to sub-round, porous, friable.

6000' Small very coarse fraction.

6060' Shale, medium gray, platy to tabular, in part silty, uniform clay.

6180' Sandstone, light gray to light buff, medium to coarse-grained.

6370' Shale, light to medium olive-gray.

6430' Sandstone, as above.

6580' Few small pelecypods.

6650' Shale, as above, with siltstone interbeds.

6680' Interbeds of sandstone, light gray, fine to medium grained, with pelecypod shells.

6740' Shale, as above.

6790' Clay, light to medium olive-gray, with shell fragments and calcareous bodies.

6880' Shale predominates, in part silty.

6910' Shale is orange-buff, in part.

6950' Siltstone grading to very fine-grained sandstone, light to medium gray.

7000' Samples missing.

7230' Shell marl of robust pelecypods in fine to medium-grained sandstone.

7260' Gastropod shells.

7340' Siltstone, light olive-gray, and shale, medium gray.

7370' Shell beds as above.

7410' Coal beds in dark shale; sulphur.

7430' Clay, light gray, with small disseminated carbonaceous fragments.

7450' Shale, medium gray, with light brown variegation; platy to tabular, somewhat brittle, resistant smooth, clay.

7490' Siltstone, light olive-gray.

7500' Shell fragments.

7570' Shale, medium to dark gray, soft, platy, clay.

7600' Thin siltstone interbeds.

7630' Few shells.

7720' More abundant shells.

7810' Thin siltstone, light olive-gray.

7870' Siltstone grades to very fine-grained sandstone.

7910' Coal seams; clay light gray.

7950' Siltstone, light to medium olive-gray, argill.

8010' Shale, medium to dark gray and olive-gray, platy to tabular, smooth, massive, clay.

8330' Sandstone, white, fine-grained, calcareous, with shells.

8400' Sandstone, white, very fine-grained, uniform, calcareous.

8430' Shale, medium to dark gray and gray-brown, smooth tabular, clay.

8460' Shale is mostly platy; in part medium gray.

8500' Samples missing.

8600' Siltstone, medium gray, and shale, as above.

8700' Few carbonized plant fragments.

8810' Siltstone, medium gray, argillaceous, with white, calcareous pellets.

8900' Siltstone assumes interbeds of shale, medium to dark gray, in part calcareous.

9080' Shale, medium to dark gray, with some brown variegation , and siltstone, medium gray, with carbonaceous laminations.

9390' Shale predominates, in part splintery.

9480' Shale is dark gray and gray-brown, in part.

9550' Thin siltstone interbeds.

9600' Few pelecypod shells.

9630' Sandstone, light gray to light buff, very fine to fine-grained, well- indurated.

9690' Shale, as above.

9720' Siltstone, medium gray, with white, calcareous bodies.

9790' Samples missing.

9880' Siltstone to very fine-grained sandstone, medium gray.

9900' Shale, dark gray to gray-brown, somewhat brittle, resistant, tabular clay.

9980' Sandstone, medium gray, very fine-grained, argillaceous.

10070' Marl, white, soft, chalky.

10130' Siltstone, medium gray to gray-brown, calcareous.

10250' Shale, dark gray and gray-brown, platy to tabular smooth, clay.

10310' Siltstone interbeds.

10350' Marl, light gray, silty, platy.

10420' Shale, as above.

10470' Siltstone grading to very fine-grained sandstone, medium gray.

10500' Samples missing.

10550' Shale, as above, massive, uniform.

Sample Total Depth: 10903'

Samples commence in sands typical of lithosome II and III, and significant shell accumulations and coals occur from 7230' to 7450'. Shale of lithosome IV is encountered at 7570', and of lithosome V at 9900'.

HUMBLE OIL AND REFINING COMPANY
GADCHAUX SUGARS NO.3

Section 24 - T13S, R13E, Assumption Parish (Well No. 5)

Sample Interval: 11000' to 12698'

Samples are recovered from within lithosome V, hence are dark shale and associated siltstone and very fine grained sandstone.

SHELL OIL COMPANY
MITCHELL NO.1

Section 1 - T14S, R12E, Assumption Parish (Well No. 6)

Sample Interval: 8500' to 9450' and 10385' to 11670'

Samples from the upper interval are of lithosome IV. The lower interval is typical of lithosome V, siltstone grading to very fine-grained sandstone is fairly well developed at the expense of dark shale.

W. CHRISTIAN DRILLING COMPANY
LONG-BELL LUMBER COMPANY NO. 1

Section 26 - T2S, R8W, Beauregard Parish (Well No. 7)

Sample Interval: 0' - 4997'

0' Sand, light buff-orange, poorly-sorted, very fine to coarse-grained, silty, argillaceous.

300' Conglomerate of coarse, varicolored, orange, brown, gray, and yellow, sub-round chert pebbles in matrix of white, unsorted sand, in part very coarse, clear quartz.

500' Sand, white, fine to medium-grained, sub-angular, well-sorted, clear quartz, unconsolidated.

610' Clay, light gray and very light olive-buff, soft, smooth, plastic, non-calcareous. Zones of fine-grained floating quartz.

750' Few white, calcareous bodies.

790' Shale, very light gray, smooth, uniform, massive, slightly calcareous.

940' Calcareous clay, as above, with fragments of delicate pelecypod shells.

990' Clay is very light gray, bentonitic.

1010' More robust pelecypod shells.

1120' Sand, light, gray-buff, poorly-sorted, fine to medium-grained, with a coarse fraction, sub-angular to sub-round, unconsolidated to loosely indurated.

1260' Sand, light gray-buff, very fine to fine-grained, silty.

1360' Sand assumes granule fraction.

1390' Clay, very light gray, smooth, calcareous.

1420' Sandstone, light buff, very fine to fine-grained, silty, porous, friable.

1570' More abundant silt.

1670' Clay, light gray, smooth, calcareous, as above.

1740' Samples missing.

1840' Sand, light gray-buff, unsorted, fine to coarse-grained, with granules as above.

1930' Clay, very light olive-green to very light gray, with white calcareous nodules and pelecypod shells.

2060' Sandstone, light buff, fine-grained, silty, with coarse-grained fraction.

2130' Clay, very light gray, maroon-mottled, smooth, bentonitic, calcareous, with pelecypods.

2180' Sandstone, as above.

2250' Clay, light gray, soft, smooth, calcareous.

2270' Abundant white, calcareous nodules.

2380' Sandstone, as above.

2440' Calcareous clay, as above.

2460' (Core) Clay, light to medium gray and olive-gray, somewhat gritty, plastic when wet, non-calcareous.

2500' Siltstone; light olive-buff, uniform clay, as above.

2530' Samples missing.

2600' Siltstone and clay, as above.

2640' Sandstone, light buff, very fine-grained, silty, fairly well-consolidated.

2710' Siltstone as above, with calcareous inclusions.

2740' Silty sandstone, as above.

2810' Sand, light buff, fine to medium-grained, sub-round.

2930' Clay, light olive-gray, soft, smooth, bentonitic,.

2950' Samples missing.

3190' Clay, light gray, smooth, soft, calcareous; siltstone, light olive-gray.

3310' Sand, medium to very coarse-grained, not well-sorted, sub-angular to sub-round, unconsolidated.

3340' Intercalations of yellow-buff, limonitic clay.

3360' Clay, light olive-gray, and siltstone, light buff.

3400' Samples missing.

3500' Sandstone, light buff, medium to coarse-grained, ashy, sub-angular to sub-round, porous, friable.

3530' Sandstone is fine to medium-grained.

3540' Clay, light olive-green to light gray, maroon-mottled. Some buff siltstone.

3580' Samples missing.

3720' Clay, light olive-gray, and siltstone, light buff.

3740' Sandstone, light gray, very coarse-grained, granular, sub-angular, clear quartz.

3780' Clay, light olive-gray, slightly calcareous, soft, smooth.

3850' Siltstone with very fine-grained fraction.

3890' Sand, light buff, fine to coarse-grained, unsorted sub-angular.

3950' Clay, light gray and light olive-green.

4050' Shale, medium gray, calcareous.

4140' Clay, light olive-green, smooth, soft.

4160' Shale, as above.

4210' Clay, as above, with limonitic stain.

4250' Siltstone and sandstone, light buff, very fine-grained, uniform.

4310' Clay, light olive-green, smooth, soft.

4330' Sandstone, light gray, very fine-grained.

4370' Shale, light gray, with carbonized plant fragments.

4410' Sand, light gray, fine to medium-grained, poorly-sorted, sub-angular to sub-round.

4440' Sand is indurated; assumes coarse fraction.

4450' Shale, as above.

4470' Sandstone, as above.

4600' Shale, medium to dark gray-brown with coal seams.

4680' Shale, medium gray, platy to tabular, and gray-brown, silty, with carbonized plant fragments, floating sand grains, and microfossils.

4780' Sandstone, light buff, fine to medium grained, poorly-sorted, sub-angular to sub-round.

4810' Samples missing.

4940' (Core) Shale, medium olive-gray, platy to tabular, with carbonized plant fragments and delicate shells.

4990' (Core) Shale, as above.

Sample Total Depth: 4997'

This well is the most northern penetrating rocks below the massive sand of lithosome III to be examined in study. The upper 500 feet are samples of sand and gravel of lithosome I, followed by massive clay and sand of lithosome II. Lithosome III is picked where significant shells occur at 1930' and lithosome IV at 4050' where medium gray, massive shale is penetrated.

PLYMOUTH OIL COMPANY
WM. CYPRESS NO. 1

Section 33-T12S, R11E, Iberia Parish (Well No. 8)

Sample Interval: 7165 to 8630' and 10730 to 11898'

7165' (Core) Sandstone, medium gray-green, very fine-grained, with small medium-grained, rounded fraction; small pelecypod shells, argillaceous ashy, silty.

7190' (Core) Shale, medium olive-gray, silty, with pelecypod shells.

7220' (Core) Interbeds of siltstone, light olive-gray, grading to sandstone, light gray, very fine-grained, loosely consolidated, with abundant small shells.

7240' (Core) Siltstone and shale, as above.

7260' (Core) Shale, light to medium olive-gray, smooth, clay, with black, carbonaceous flakes.

7270' (Core) Sandstone, medium gray, very fine-grained, marly.

7280' (Core) Shale, dark gray to black, carbonaceous.

7310' (Core) Shale,medium to dark olive-gray, smooth, clay.

7340' (core) Shale, as above, with carbonaceous flakes.

7360' (Core) Shale, is slightly silty.

7380' (Core) Few pelecypod shells.

7390' (Core) Sandstone, medium gray, very fine-grained, platy, silty.

7420' (Core) Shale, as above.

7450' (Core) Siltstone, medium olive-gray, platy, argillaceous.

7480' (Core) Shale, dark gray-brown, silty to very fine arenaceous.

7510' (Core) Siltstone, medium olive-gray, argillaceous.

7540' (Core) Sandstone, medium gray, fine to medium-grained, marly,.

7560' (Core) Sandstone, medium to fine-grained, clean. Shale, dark gray, carbonaceous, with coal seams.

7590' (Core) Sandstone, medium gray, very fine to fine-grained.

7630' (Core) Sandstone, as above, with white, chalky marl.

7650' (Core) Sandstone, light gray, fine-grained, well-sorted, angular to sub-round, uniform, loosely consolidated.

7680' (Core) Siltstone, medium, gray to gray-brown, argillaceous.

7700' (Core) Sandstone, as above.

7730' (Core) Sandstone is light gray, silty, ashy.

7760' (Core) Sandstone, as above.

7810' (Core) Shale, medium to dark gray-brown, smooth, very slightly silty, clay.

7840' (Core) Shale, as above, grading to argillaceous siltstone.

7870' (Core) Shale, as above, with gastropod shells.

7890' (Core) Shell marl, white, silty.

7920' (Core) Sandstone, light gray, very fine-grained, uniform, soft, ashy.

7960' (Core) Shale, medium to dark gray-brown, as above.

7990' (Core) Interbeds of siltstone, medium gray.

8000' Samples missing.

8080' (Core) Siltstone, with small very fine sandstone.

8110' (Core) Thin interbeds of shale, dark gray or gray-brown, in siltstone, as above.

8140' (Core) Siltstone is interlaminated with very fine-grained sandstone.

8150' Samples missing.

8220' (Core) Sandstone, white to light gray, fine to medium-grained, porous, friable, sub-angular to sub-round. Partings of dark gray, fissile shale.

8250' (Core) Sandstone, medium-grained.

8270' (Core) Shale, dark gray-brown, silty, fissile.

8290' (Core) Few carbonaceous flakes.

8310' (Core) Abundant small, delicate pelecypod shells.

8320' (Core) Siltstone to very fine-grained sandstone, medium gray.

8330' (Core) Sandstone, light gray, very fine-grained, carbonaceous.

8350' (Core) Coal seams and dark carbonaceous shale.

8370' (Core) Shell marl and fine-grained sandstone.

8390' (Core) Shale, medium to dark gray-brown.

8410' (Core) Siltstone, medium gray, argillaceous, with pelecypod shells.

8430' (Core) Shale, as above.

8440' (Core) Sandstone, fine to medium-grained, as above.

8460' (Core) Siltstone, medium gray, ashy.

8490' (Core) Siltstone, fossiliferous, as above.

8500' (Core) Shale, dark gray, carbonaceous.

8510' (Core) Sandstone, light brown, very fine-grained, with ferruginous stains.

8530' (Core) Sandstone, light gray, fine-grained.

8630' Samples missing.

10730' Shale, dark gray to gray-brown, platy to tabular, silty.

10760' Siltstone interbeds.

10780' Sandstone, medium gray, sub-angular to sub-round, loosely consolidated.

10800' Sandstone, medium brown, very fine-grained, argillaceous.

10820' Carbonaceous seams in very dark gray shale.

10840' Shale, medium dark gray-brown, as above.

10870' Sandstone, medium brown, very fine-grained, argillaceous.

10930' Siltstone, medium gray.

11000' Sandstone, light gray, very fine-grained, silty.

11010' Sandstone, fine to medium-grained, with a few shells.

11030' Shale, dark gray to gray-brown, as above.

11050' Interbeds of siltstone to very fine-grained sandstone.

11070' Shale is medium gray in part.

11100' Shale, dark gray-brown, somewhat brittle, clay.

11120' Shale is brown to red-brown, in part.

11140' Sandstone, light gray, fine-grained, silty.

11170' Sandstone, fine-grained with small medium-grained fraction; few shells.

11230' Sandstone assumes silty admixture.

11260' Shale, dark gray-brown, brittle, blocky to platy.

11280' Sandstone, as above.

11300' Claystone, medium gray, silty, with chalky marl.

11330' Shale, medium to dark gray-brown, soft, frangible.

11340' Siltstone, medium gray.

11360' Sandstone, fine-grained, as above.

11370' Siltstone, medium gray, massive, argillaceous,.

11400' Siltstone grades to very fine-grained sandstone.

11410' Shale and siltstone, as above.

11580' Siltstone grades to very fine-grained sandstone.

11590' Sandstone, fine to medium-grained, sub-round.

11600' Shale, dark gray-brown, somewhat brittle, resistant slightly silty, clay.

11700' Trace of red-brown shale.

11710' Shale is very dark gray-brown, in part.

11740' Siltstone, medium gray-brown.

11800' Sandstone, medium gray, very fine-grained, silty.

11840' Shale, dark gray to gray-brown, blocky.

Sample Total Depth: 11898'

The upper interval of cores is taken from lithosome III, hence includes sands, marls, clays, and carbonaceous shales. The lower interval is typical of lithosome V where siltstone and very fine-grained sandstone are enclosed in dark shale.

HUMBLE OIL AND REFINING COMPANY
FEDERAL LAND BANK NO. 1

Section 1 - T11S, R13E, Iberville Parish (Well No.9)

Sample Interval: 4380' to 11908'

4380' Sandstone, light gray, coarse-grained, poorly-sorted; clay and siltstone, light olive and red-brown.

4440' Sandstone, light buff-gray, very coarse and coarse-grained, with granules of quartz and chert, unsorted, poorly consolidated. Siltstone , light olive-gray.

4500' Samples missing.

4645' Siltstone, light olive-gray, and light gray, argillaceous.

4710' Clay, light olive-gray, silty.

4750' Clay is red-brown, variegated, in part.

4800' Sandstone, light gray, medium-grained, sub-angular to sub-round. Variegated siltstone, as above.

4830' Siltstone is light olive; few shells.

4890' Sandstone, light gray, medium to coarse-grained, sub-angular to sub-round, not well-sorted, poorly consolidated, massive.

4920' Shell marl in sandstone, with weathered robust pelecypod shells.

4960' Sandstone and siltstone, as above.

5060' Shell beds, as above.

5090' Coal seams.

5220' Coal beds and siltstone, light olive-green.

5260' Interbeds of sandstone, light gray, medium-grained, silty.

5360' Sandstone, as above, massive.

5390' Coal seams.

5420' Sandstone, as above, with small shell fragments.

5480' Siltstone, light olive-green; clay, light gray.

5600' Shell fragments.

5630' Siltstone and clay, as above.

5670' Shale, light to medium gray and gray-brown, tabular, clay.

5690' Carbonaceous flakes and coal seams.

5720' Interbeds of siltstone, light olive-gray.

5770' Siltstone predominates.

5900' Clay and siltstone, as above.

5930' Coal seams with sulphur.

6010' Abundant shell fragments.

6030' (Core) Siltstone, light olive-gray; coal or carbonaceous shale seams. Shell beds of robust pelecypods.

6080' Siltstone and clay, as above.

6110' Clay or shale, light gray, blocky, with shells.

6170' More abundant siltstone interbeds.

6220' Abundant shells in light gray clay shale.

6280' Few carbonized plant fragments.

6370' Siltstone, light olive-gray.

6410' Shale, light gray to medium gray, tabular.

6440' Coal seams.

6460' Siltstone, as above.

6730' Sandstone, light gray, medium-grained, silty.

6760' Interbeds of siltstone, light olive-gray; shale, light gray, with carbonized plant fragments.

6810' Few shells.

6910' Shale, medium gray-brown, platy to tabular, smooth, clay.

7040' Interbeds of siltstone, light olive-gray.

7110' Sandstone, light gray-brown, fine-grained.

7210' Coal seams.

7230' Sandstone, very coarse and coarse-grained, sub-round, poorly-sorted.

7340' Siltstone and shale, as above; coal seams.

7410' Carbonaceous shale with coal seams.

7450' Shell beds; coal seams.

7500' Siltstone, light olive-gray, grading to very fine grained sandstone.

7530' Shale, medium gray-brown, and siltstone, light olive-gray; carbonized plant fragments.

7560' Shale predominates, platy to tabular, clay, massive.

7860' Siltstone, light to medium olive-gray; coal seams with sulphur.

7900' Coal beds.

7990' Siltstone, light to medium olive-gray.

8070' Shale, medium gray-brown, with carbonized plant fragments.

8110' Coal seams and beds.

8200' Siltstone, as above.

8340' Shale, medium to dark gray-brown, tabular, clay. coal seams.

8480' Thin interbeds of sandstone, light gray, fine-grained.

8520' Few delicate pelecypod shells.

8630' Sandstone, very coarse to coarse-grained, not well-sorted, sub-angular to sub-round, poorly consolidated, massive.

8660' Shale, medium to dark gray-brown, blocky to tabular.

8690' Few shells.

8720' Siltstone, medium olive-gray, with coal seams.

8770' Gastropod shells.

8790' Interbed shale and siltstone, as above.

8900' Shale predominates.

9000' Siltstone grades to sandstone, very fine-grained, calcareous.

9100' Shale is carbonaceous in part.

9240' Coal seams.

9270' Siltstone grading to very fine-grained sandstone, as above.

9320' Sandstone, light gray, very fine to fine-grained, calcareous.

9350' Sandstone is silty, non-calcareous.

9380' Interbeds of shale, as above.

9440' Coal beds.

9470' Sandstone, medium gray-brown, very fine-grained to silty, calcareous, oil-stained.

9500' Sandstone, white or light gray, fine-grained, calcareous.

9540' Sandstone, medium brown, very fine to fine-grained non-calcareous , oil-stained.

9570' Sandstone, is calcareous.

9600' Shale, dark gray-brown, smooth, tabular, clay.

9680' Sandstone, medium brown, very fine-grained, silty, calcareous, with shell fragments; oil-stained.

9710' Siltstone predominates.

9770' Shale, as above.

9810' Interbeds of siltstone, light to medium gray, with carbonaceous flakes.

9840' Shale, as above, uniform, massive.

9910' Interbeds of siltstone, as above, with a few carbonaceous seams.

9990' Shale, as above, massive.

10220' Few shells; thin siltstone interbeds.

10310' Sandstone, light to medium gray, very fine-grained silty, calcareous.

10350' Shale, as above.

10400' (Core) Siltstone and sandstone, light-gray to medium brown, very fine-grained, non-calcareous, with carbonaceous flakes.

10450' (Core) Shale, as above, dark-gray-brown, clay.

10470' (Core) Siltstone, light to medium gray, in thin, platy interbeds.

10490' (Core) Sandstone, light to medium-gray, fine-grained, calcareous.

10510' (Core) Limestone, light brown, mealy to crystalline, foraminiferal.

10520' (Core) Sandstone, medium gray, fine-grained, calcareous, argillaceous; few coarse floating sand grains, dark carbonaceous shale blebs.

10550' (Core) Shale, as above, with interbeds of medium gray, non-calcareous siltstone.

10570' (Core) Sandstone, light gray, fine to medium-grained, porous, friable.

10580' (Core) Shale and siltstone, as above.

10680' Siltstone predominates.

10740' (Core) Sandstone, light to medium gray, fine-grained, calcareous.

10760' (Core) Siltstone, medium gray, calcareous, with carbonaceous flakes.

10780' (Core) Sandstone, light gray, fine-grained, sub-round, porous, friable.

10800' (Core) Shale and siltstone, as above.

10860' (Core) Sandstone, medium gray, fine to medium-grained, sub-round, calcareous, resistant.

10890' Sandstone grades to very fine to fine-grained, not calcareous, porous; shale partings.

10920' (Core) Shale and siltstone, as above.

10930' (Core) Sandstone is light gray, fine to medium-grained, friable.

10940' (Core) Interlaminated shale and siltstone.

10950' (Core) Sandstone grades to marly limestone.

10980' (Core) Sandstone is medium to coarse-grained in part. Carbonaceous shale partings.

11000' (Core) Sandstone, medium gray, fine to medium-grained, calcareous.

11030' Shale, as above.

11100' (Core) Shale, dark gray-brown or olive-brown, somewhat brittle, platy to tabular , with small carbonaceous flakes; siltstone interbeds, grading to very fine-grained sandstone.

11230' Shale, very dark gray-brown, platy to tabular, massive, clay.

11380' Siltstone, grading to very fine-grained sandstone, calcareous.

11420' (Core) Shale, as above.

11500' Sandstone, light gray, fine-grained, non-calcareous, thin-bedded.

11540' Shale, as above, massive.

11820' Interbeds of siltstone and sandstone, light gray, fine-grained, calcareous.

Sample Total Depth: 11908'

Samples commence near the base of lithosome II, with lithosome III picked on the first occurrence of abundant shells at 4920'. Coals are well developed in the 7200' to 8000' interval, with shale of lithosome IV at 8350'. Dark shale with very well developed,calcareous sandstones below about 8600' belong to lithosome V.

HUMBLE OIL AND REFINING COMPANY
M. KRATZNER NO. 1

Section 12 - T9S, R4W, Jefferson Davis Parish(Well No.10)

Sample Interval: 2000' to 8830'

2000' Siltstone, light olive-green, very argillaceous, with fine-grained sand admixture, grading to silty, argillaceous sand.

2060' Some fine-grained sand; argillaceous, ashy.

2100' Sand assumes medium-grained fraction, some dark grains and carbonized plant fragments.

2210' Clay is more abundant, olive-green, soft, silty, arenaceous, with orange ferruginous staining.

2300' Samples missing.

2360' Clay with silty-arenaceous admixture, as above.

2440' Clay assumes white, calcareous bodies and pelecypod shell fragments; calcareous zones.

2520' Calcareous zone approaches resistant, earthy, argillaceous limestone.

2540' Pelecypod shell beds.

2570' Clay and argillaceous siltstone, olive-green, as above.

2590' Shell coquina, as above; peleypods and gastropods.

2610' Clay and siltstone, as above.

2650' Limestone and coquina, as above; many shells intact.

2700' Some black, carbonaceous shale.

2770' Siltstone and sand, light olive-green.

2800' Samples missing.

2840' Clay, light olive-green, soft, silty.

2940' Shell beds, as above.

2960' Samples missing.

3725' (Core) Sandstone, light olive-buff, very fine-grained, silty, argillaceous, porous, very loosely consolidated, well-sorted.

3738' Samples missing.

4280' Clay and calcareous claystone, medium olive-green, in part fairly resistant, smooth, blocky. Darker than clays above.

4390'	Clay color change to medium gray, with dark ferruginous specs.
4420'	Pelecypod shell beds.
4480'	Siltstone, light olive-gray, argillaceous.
4520'	Shale, black, carbonaceous.
4540'	Clay, medium gray to olive-gray, smooth, with black specs.
4640'	Sand, light gray, coarse to very coarse-grained, sub-round to round, porous, unconsolidated.
4710'	Clay, as above.
4780'	Sandstone, light gray to buff, very fine to medium-grained, unsorted, with coarse fraction, sub-round to round, clear quartz.
4820'	Sand or sandstone, as above, coarse to very coarse-grained.
4860'	Sand, fine to medium-grained, sub-angular to sub-round, poorly-sorted, unconsolidated.
4920'	Clay and calcareous claystone, light olive-gray, smooth; in part resistant, earthy limestone.
4950'	Samples missing.
5080'	Sand, light gray, fine to medium-grained with coarse fraction, very porous, sub-angular to sub-round, clear, unconsolidated quartz.
5120'	Black chert grains.
5240'	Siltstone, light olive-buff, very argillaceous, ashy.
5260'	Samples missing.
5340'	Siltstone, as above, and shale, medium gray, maroon-mottled.
5440'	Samples missing.
5560'	Clay, medium gray, maroon-mottled, with silty zones.
5580'	Samples missing.

5760' Clay, light olive-green, smooth, blocky, variegated with maroon and medium gray.

5800' Siltstone to fine-grained sandstone, light olive-buff.

5820' Clay and calcareous claystone, olive-green; few shell fragments.

5860' Samples missing.

5880' Clay and siltstone, as above.

5920' Siltstone and medium-grained sandstone.

6250' Clay, light olive-green, silty, and shale, medium to dark gray, carbonaceous.

6280' Siltstone, light olive buff, with fine-grained, arenaceous zones.

6300' Samples missing.

6380' Siltstone and clay, as above.

6440' Clay, light olive-green, smooth, uniform, blocky, somewhat resistant, calcareous.

6480' Clay assumes siltstone lenses.

6500' Oyster beds; abundant large shells.

6540' Interbeds of sand, fine to medium-grained, round.

6570' Samples missing.

6620' Clay, medium gray-brown, smooth, uniform, blocky to platy.

6640' Clay grades to olive-brown, platy to tabular; with pelecypod shells and calcareous zones.

6770' Siltstone lenses.

6900' Sandstone, light olive-green, very fine to fine-grained, with small medium-grained fraction, very argillaceous, ashy.

6940' Sandstone assumes silt admixture.

6960' Clay, as above, massive,.

7000' (Core) Clay, as above; siltstone, light olive-gray.

7020' Few shells.

7100' Shale, black, fissile, carbonaceous, in thin seams.

7220' Siltstone interbeds in shale, as above.

7240' Sandstone, thin bedded, light gray, very fine-grained.

7300' Clay becomes somewhat fissile shale.

7350' Siltstone, in part arenaceous.

7480' Shale, medium to dark olive-gray, platy-tabular non-calcareous, with small carbonized plant fragments, floating silt grains, pyrite.

7540' (Core) Clay, medium gray, calcareous, smooth, blocky, finely micaceous.

7570' Siltstone, light gray, interbeds.

7640' Shale color grades to dark gray.

7730' Siltstone, grading to very fine-grained sandstone, carbonaceous.

7780' (Core) Siltstone, as above, argillaceous.

7800' Shale, dark gray, as above, with some green and maroon variegation.

7840' Sandstone, medium gray, very fine-grained, silty; a thin interbed.

7900' Shale, medium to dark olive-gray, smooth, blocky.

7950' (Core) Siltstone, medium gray, grading to very fine-grained, argillaceous sandstone.

8000' Shale, as above.

8030' (Core) Siltstone and sandstone, light olive-gray, fine to medium-grained, poorly sorted, sub-angular to sub-round, very friable, porous.

8120' Shale, medium to dark olive-gray, platy to tabular, smooth, somewhat resistant.

8150' Stringers of sandstone, as above.

8160' Shale becomes calcareous.

8280' Siltstone, light olive-green, argillaceous, ashy.

8300' Shale, medium to dark olive-gray, platy to tabular smooth, clay; non-calcareous.

8380' Sandstone, light gray, very fine to fine-grained, with small medium-grained fraction, sub-angular to sub-round, loosely consolidated, porous.

8420' Shale, as above.

8430' Sandstone, light gray, medium-grained, sub-round to round.

8450' Shale, as above, slightly calcareous.

8470' (Core) Shale, as above, with siltstone lenses.

8500' Shale fragments are platy to tabular.

8520' (Core) Shale, as above, massive except for thin medium gray, resistant siltstone stringers.

8760' (Core) Sandstone, light gray, fine to medium-grained, sub-round, uniform, argillaceous, ashy, friable.

8830' (Core) Siltstone to very fine-grained sandstone, light gray.

Sample Total Depth: 8830'

Samples commence near the base of lithosome II, with very well developed limestone and coquina of lithosome III at 2460'. Shale of lithosome IV is penetrated at 7480' but lithosome V is not reached by the well.

HUMBLE OIL AND REFINING COMPANY
LaRAB LAND COMPANY NO. 1

Section 8 - T14S, R23E, Jefferson Parish (Well No. 11)

Sample Interval: 5090' to 9922'

Samples commence in massive sandstone, more than 1000 feet thick which eliminates usual silty clay of lithosome II and III, but contains many shells. At 6260', shells, and coal seams of lithosome III are present, and at 6990', shale of lithosome IV is penetrated. At 8385', dark shale of lithosome V is reached.

HUMBLE OIL AND REFINING COMPANY
LaRAB LAND COMPANY No.2

Section 8 - T14S, R23E, Jefferson Parish (Well No. 12)

Sample Interval: 6970' to 10000'

Samples commence near the base of lithosome III in light olive-green clay and sandstone, with gray shale of lithosome IV at 7260'. Dark shale of lithosome V is below 8300'.

EASON OIL COMPANY
CELOTEX UNIT 12, NO. 1

Section 11 - T14S, R23E, Jefferson Parish (Well No. 13)

Sample Interval: 6195' to 9293'

Samples commence in coarse sand near the base of lithosome II or in lithosome III, continue through shell beds and silts with coal seams to shale of lithosome IV at 7460'. Dark shale of lithosome V is reached at 8430'.

ANSON PETROLEUM CORPORATION
CELOTEX CORPORATION NO.6

Section 12 - T14S, R 23E, Jefferson Parish (Well No. 14)

Sample Interval: 5000' to 10030'

Samples commence low in lithosome II reaching lithosome III at5320'. Coarse sand, carbonaceous shale, and shell beds of III are replaced by shale and siltstone of lithosome IV at 6730'. Dark shale of lithosome V prevails below about 8300'.

ANSON PETROLEUM CORPORATION
MARRERO TOOL AND IMPLEMENT COMPANY NO. 7

Section 22 - T14S, R23E, Jefferson Parish (Well No. 15)

Sample Interval: 5990' to 9832'

Samples commence in silt and shell beds of lithosome III, with shale of lithosome IV at 6820'. Dark shale of lithosome V occurs below 8350'.

ANSON PETROLEUM CORPORATION
CELOTEX SAND UNIT 18, NO.1

Section 73 - T14S, R23E, Jefferson Parish (Well No. 16)

Sample Interval: 6000' to 9539'

Samples commence in siltstone with shell beds and coal seams of lithosome III. Shale of lithosome IV is reached at 6970', and dark shale with siltstones of lithosome V at 8540.

HUMBLE OIL AND REFINING COMPANY
CITY OF NEW ORLEANS NO. 1

Section 73 - T14S, R23E, Jefferson Parish (Well No. 17)

Sample Interval: 120' to 9798'

120' Sandstone, light gray, very fine-grained, angular, silty, poorly sorted.

150' Clay, light gray to light olive-green, silty, with abundant delicate pelecypods.

180' Floating quartz grains.

210' Sandstone, fine to coarse-grained, unsorted, in part red-orange, ferruginous.

240' Robust pelecypods.

270' Carbonaceous plant remains.

320' Clay, light to medium olive-gray, silty, arenaceous, with abundant small pelecypod shells.

390' Sandstone, light gray to yellow-buff, fine-grained, limonitic.

420' Sandstone, assumes coarse fraction.

430' Plant remains, dark brown, lignitic.

450' Small gastropod shells.

460' Sandstone, coarse-grained, sub-round, with plant remains.

510' Sandstone is very coarse to granular.

570' Gastropods and echinoids.

680' Shell beds, unconsolidated, with no matrix, including numerous gastropods, bryozoans, echinoids, etc.

730' Interstitial clay.

780' Lignitic plant remains; no matrix.

870' Sandstone, coarse to very coarse-grained, with abundant shells.

930' Fewer shells.

990' Barnacle plates.

1090' Siltstone, light olive-gray, grading to very fine-grained sandstone; argillaceous.

1120' Sandstone is coarse to very coarse-grained.

1140' Sandstone assumes granule fraction.

1200' Lignitic plant remains and carbonaceous clay.

1230' Sandstone, as above.

1420' Shell beds, as above; mollusks and echinoids.

1470' Interstitial clay.

1560' Lignitic plant remains; sticks and stalks.

1590' Sandstone, coarse to very coarse-grained, rounded.

1620' Siltstone and clay, light to medium olive-gray.

1650' Sandstone, very coarse-grained to granular, rounded.

1700' Clay, olive-gray, silty.

1730' Siltstone predominates.

1820' Few delicate pelecypod shells.

1870' Sandstone, granular, thin bed.

1890' Clay and siltstone, as above, bentonitic.

2020' Siltstone, light olive-gray to buff.

2180' Red-brown variegation.

2200' Siltstone, grading to very fine-grained sandstone, argillaceous.

2400' Sandstone, light olive-gray, very fine to medium-grained, poorly - sorted, argillaceous.

2430' Some granular sandstone.

2460' Sandstone is medium to coarse-grained.

2490' Siltstone, light olive-gray, argillaceous.

2540' Clay predominates.

2580' More abundant siltstone.

2690' Clay predominates.

2800'	Shale, medium gray, with carbonized plant fragments.
2880'	Sandstone, granular, as above
2940'	Interbeds of siltstone and clay, as above.
2970'	Lignite.
3120'	Chert Pebbles, yellow, gray, and brown.
3140'	Siltstone, light olive-gray.
3210'	Siltstone and clay, light olive, with some red-orange variegation.
3240'	Sandstone fine to coarse-grained, unsorted, sub-round.
3270'	Clay and siltstone, as above.
3300'	Trace of shale, medium gray, smooth, clay.
3510'	Siltstone predominates.
3630'	Shale, dark gray-brown, lignitic.
3680'	Siltstone and clay, as above.
3880'	Shale, medium gray, carbonaceous, clay, thin bed.
4020'	Siltstone and clay, variegated.
4180'	Sandstone, very fine-grained, silty, with delicate pelecypod shells.
4200'	Sandstone is granular and cherty.
4210'	Siltstone, as above.
4410'	Siltstone grade to very fine-grained sandstone, in part.
4600'	Coal seams and few shells in siltstone.
4650'	Clay and shale, light to medium gray and olive-gray.
4890'	Shale, medium gray, with carbonized plant frags.
5000'	Coal seams and carbonized plant fragments in gray shale.

5050' Sandstone, medium to coarse-grained, loosely consolidated, rounded.

5070' Clay, as above, with shells.

5170' Coal seams and delicate pelecypod shells.

5220' Abundant shells.

5250' Shale, medium gray and olive-gray, clay, with shells.

5400' Shale, medium gray; no shells.

5460' Coal seams and shells in siltstone, as above.

5550' Shale as above.

5620' Interbeds of siltstone, light olive-gray.

5670' Shale is platy to tabular, somewhat brittle.

5850' Sandstone, very coarse to granular, loosely consolidated, rounded.

5940' Shale, medium gray, platy.

5970' Siltstone, as above, shells.

6000' Shale, medium gray to olive-gray, blocky, with small carbonized plant fragments.

6030' Sandstone, granular, and siltstone, as above.

6060' Shale, as above.

6150' Sandstone, medium to coarse-grained, witn robust pelecypod shells.

6240' Shells in siltstone.

6270' Coal beds.

6300' Siltstone and carbonaceous shale.

6460' Sandstone, white to light gray, fine-grained.

6480' Shale, medium olive-gray, blocky to platy.

6540' Coal beds in dark, carbonaceous shale.

6560' Sandstone, fine-grained, loosely consolidated, and siltstone, light olive.

6630' Sandstone, coarse to granular, rounded.

6650' Coal seams and shell beds.

6730' Sandstone, coarse to granular, cherty.

6760' Siltstone, grading to very fine-grained sandstone, argillaceous. Abundant coal and shell beds.

6930' Sandstone, coarse-grained, with abundant shells and coal seams.

7030' Sandstone, fine to coarse-grained, unsorted.

7050' Siltstone, light olive, and shale, medium olive-gray. Coal seams.

7120' Interbeds of sandstone, light gray, fine-grained, silty, with shells.

7290' Shale, medium to dark olive-gray, soft, platy to tabular, clay; massive.

7390' Coal seams.

7470' Shale is gray-brown, in part.

7710' Sandstone white to light gray, very fine to fine-grained, resistant, well consolidated, with shells.

7740' Sandstone assumes a small medium-grained fraction.

7750' Shale, as above, with sandstone interbeds, in part calcareous.

7930' Sandstone, medium-grained, calcareous, shell bed.

7950' Shale, as above.

7980' Sandstone, fine to coarse-grained, unsorted.

8010' Sandstone assumes coarse fraction; abndt.shells.

8070' Sandstone is fine to medium-grained.

8170' Siltstone grading to very fine-grained sandstone.

8300' Shell beds, as above.

8380' Sandstone fine to medium-grained, not well-sorted.

8450' Shale, medium to dark gray-brown, platy.

8500' Sandstone, coarse to granular.

8550' Shale, dark gray-brown, somewhat brittle, thin platy.

8620' Siltstone to very fine-grained sandstone, medium gray-brown, interbeds.

8650' Shale as above.

9140' Limestone, very dark brown, argillaceous, thin bedded.

9160' Siltstone grading to very fine-grained sandstone, with ferruginous concentrations.

9180' Sandstone, very fine to fine-grained, poorly-sorted, thin bedded.

9220' Samples missing.

9290' Shale and siltstone, as above.

9340' Trace of limestone, dark brown, earthy.

9380' Sandstone, light gray, fine-grained, not well-sorted, well-indurated.

9400' Shale, as above, brittle, resistant.

9420' Sandstone, light gray, very fine to fine-grained, with small medium fraction, unsorted, sub-angular; light oil stain.

9480' Siltstone, medium gray-brown, with coal seams.

9540' Sandstone, as above, with slickensides.

9680' Shale, as above.

9720' Shale is brown, ferruginous, resistant.

9750' Shale, as above.

Sample Total Depth: 9798'

MISSISSIPPI RIVER FUEL CORPORATION
CITY OF NEW ORLEANS NO. 1

Section 80 - T14S, R23E, Jefferson Parish (Well No. 18)

Sample Interval: 8000' to 10595'

Samples commence in shale in lithosome IV. Lithosome V is reached at 9020'.

THE CALIFORNIA COMPANY
BRILEY UNIT 119, NO.1

Section 2 - T16S, R23E, Jefferson Parish (Well No. 19)

Sample Interval: 5000' to 11035'

Samples commence in sandstones of lithosome III, with massive dark shale encountered at 8050'. Lithosome IV is thus virtually absent.

HUMBLE OIL AND REFINING COMPANY
CALDWELL SUGARS NO. 1

Section 115 - T14S, R15E, Lafourche Parish (Well No. 20)

Sample Interval: 2590' to 12577'

Samples commence in massive gravel in lithosome I with light-colored clay and siltstone of lithosome II at 2915'. Lithosome III is reached at 4500', lithosome IV at about 8230', and lithosome V between 9630' and 9860' where samples are missing.

GULF OIL CORPORATION
ADELE LECHE NO. 1

Section 67 - T14S, R 16E, Lafourche Parish (Well No. 21)

Sample Interval: 8980' to 12468'

Samples commence in massive gray and olive-brown

shales of lithosome IV. Lithosome V is penetrated at 10160' and includes significant sandstone, siltstone, and chalky marl.

AMERADA PETROLEUM CORPORATION
SOUTH COAST NO. 2

Section 39 - T15S, R19E, Lafourche Parish (Well No. 22)

Sample Interval: 200' to 12200'

200' Sand, very coarse, with quartz and yellow chert pebbles.

440' Few shells.

550' Interbeds of red-brown clay in sandstone.

640' Conglomerate of quartz and yellow and black chert pebbles; rounded.

700' Sandstone, medium to coarse-grained, sub-round to round.

800' Shell beds; pelecypod and gastropod shells.

880' Bryozoans and echinoids.

960' Sandstone, light gray, fine to coarse-grained, unsorted, with shells.

1060' Siltstone, medium gray, argillaceous.

1160' Sandstone, light gray, coarse to very coarse-grained, rounded.

1340' Sandstone assumes chert and quartz pebbles.

1480' Silstone and silty clay, medium gray.

1760' Pelecypods, gastropods, bryozoans, echinoids.

1800' Sandstone, light gray, fine to coarse-grained, shells.

1900' Siltstone and silty clay interbeds.

1960' Shell beds; pelecypods, gastropods, barnacles.

2380' Sandstone, light gray, fine to medium-grained, rounded, massive.

2440' Sandstone assumes coarse fraction; few pebbles.

2640' Siltstone and silty clay, light olive-gray.

2700' Sandstone, light gray, medium to coarse-grained, as above.

2880' Interbeds of siltstone, as above.

2960' Siltstone predominates.

3120' Clay, light gray, and siltstone, light olive.

3260' Clay assumes red-orange variegation, in part.

3400' Sandstone, light gray, fine to medium-grained, unsorted, with dark, carbonaceous shale and coal seams.

3520' Interbeds of siltstone, and clay, light olive.

3860' Siltstone predominates.

3960' Few pelecypod shells.

4000' Clay, light gray, soft, smooth, with siltstone, as above.

4100' Interbeds of coarse sandstone.

4300' Shale, dark gray, with carbonaceous plant frags. thin interbeds.

4520' Clay is red-brown variegated, in part.

4780' Interbeds of coarse sand.

4880' Clay and shale, medium to dark gray, in part carbonaceous; abundant robust pelecypods.

5060' Siltstone, light olive-gray, with dark gray carbonaceous shale and coal seams.

5160' Interbeds of fine-grained siltstone and clay, as above.

5500' Sandstone, light gray, coarse-grained, sub-angular to sub-round, with some yellow and brown chert grains.

5780' Siltstone, light olive, and shale, light gray, with few shells.

5880' Sandstone, medium to coarse-grained; coal seams.

5980' Siltstone and clay, as above.

6280' Interbeds of coarse sandstone, with shells, as above.

6650' Sandstone predominates.

6720' Shell beds; robust pelecypods.

6960' Coal; few shells.

7000' Clay, medium olive-gray, soft, blocky.

7060' Shell beds; robust pelecypods. Some coarse-grained, rounded sand.

7140' Siltstone, light to medium gray, and sandstone; fine-grained.

7230' Clay, medium to dark olive-gray, interbeded with siltstone, as above.

7360' Sandstone, light gray, medium to coarse-grained, with siltstone, as above; few shells.

7500' More abundant shells and black, carbonaceous seams.

7560' Sandstone is fine-grained.

7620' Siltstone, light to medium gray, massive.

7660' Shale, red-brown, variegated, and black, carbonaceous, with siltstone and sandstone, as above.

7740' Shale, medium to dark gray-brown, platy.

7820' Siltstone grading to very fine-grained sandstone, medium gray.

7840' Interbeds of shale, as above.

7880' Shale predominates.

7980' More abundant siltstone.

8060' Shale, dark gray-brown, platy to splintery.

8120' Siltstone, light to medium gray.

8180' Shale, as above.

8380' Few shells.

8460' Sandstone, light gray, very fine to fine-grained, silty, fossiliferous, with dark laminations.

8580' Sandstone is fine to medium-grained, sub-angular to sub-round, fairly well-sorted, loosely consolidated.

8750' Shale, as above; few micaceous and carbonaceous glakes. Interbeds of siltstone, gray-brown.

8860' Small pelecypods.

8900' Interbeds of medium gray siltstone.

9000' Shale, medium to dark olive-gray, platy-tabular, smooth, clay.

9100' Siltstone, medium gray, uniform, massive.

9180' Shale, dark gray-brown, platy to tabular, brittle, resistant, massive.

9760' Siltstone, medium gray, as above.

9780' Shale, dark gray-brown, as above, with trace of red-brown shale.

9830' Shale and siltstone, intercalated, with dark carbonaceous flakes.

9940' Siltstone grading to very fine-grained sandstone, medium gray-brown, resistant.

10100' Shale, dark to very dark gray-brown, blocky to platy, brittle, resistant, calcareous.

10200' Shale is tabular and fissile, in part.

10280' Siltstone, medium gray-brown, grading to very fine-grained sandstone, in part.

10500' Shale, dark gray-brown, platy to tabular, slightly calcareous.

10560' Siltstone to very fine-grained sandstone, medium gray-brown.

10600' Interbeds of shale, dark gray, carbonaceous.

10660' Shale, medium to dark gray-brown, soft, blocky, clay.

10920' Shale is dark gray-brown, blocky to platy, clay.

10950' Siltstone interbeds.

11000' Shale, medium to dark gray-brown or olive, blocky to platy, smooth , clay.

11080' Shale is medium brown, micaceous in part, with some silt.

11150' Sandstone, light gray, fine to medium-grained sub-round.

11170' Siltstone, medium gray-brown.

11220' Shale, medium to dark gray and brown, with red-brown variegation, blocky, clay.

11300' Siltstone, grading to very fine-grained sandstone, thin bed.

11340' Sandstone, as above.

11420' Shale, as above, with resistant siltstone.

11510' Sandstone and siltstone, as above.

11590' Siltstone predominates.

11620' Shale, as above.

11860' Siltstone to very fine-grained sandstone, medium gray-brown, carbonaceous in part.

12010' Shale, medium to dark gray-brown, blocky to platy, with silty zones, grading to very fine-grain sandstone.

12160' Trace of red-brown shale.

Sample Total Depth: 12,200'

Sample commence in gravels of lithosome I, with clay and siltstone of lithosome II at about 1400'. Shell beds and coal seams of lithosome III occur below 3400' and shale of lithosome IV at 7700'. Massive dark shales of lithosome V are penetrated at 9180'.

PAUL F. BARNHART
J. B. LEVERT LAND COMPANY NO. 1

Section 115 - T15S, R16E, Lafourche Parish (Well No. 23).
Sample Interval: 6500' to 13010'

Samples commence in sands of lithosome III, with massive shale of lithosome IV reached at 7880'. Dark shale of lithosome V is penetrated at about 10060'.

FOHS OIL COMPANY
STATE LONG LAKE NO. 4

Section 77 - T17S, R19E, Lafourche Parish (Well No. 24)

Sample Interval: 3060' to 10472'

Samples commence in light-colored clay and silt lithosome II, with coal beds of lithosome III first noted at 3850'. Shale of lithosome IV appears at 7610', but intertongues with the unit above. Dark shale of lithosome V is penetrated at 9060'.

BRAZOS FARM NO. 8
(Well No. 25)

Sample Interval: 3078' to 3676'

Cores from a Lafourche Parish well for which the location is unknown. This is a salt-dome well, with shell beds, clay, and sandstone typical of lithosome III above.

the dolomite-anhydrite cap-rock.

THE CALIFORNIA COMPANY
W. R. TIMKEN NO. 5

Section 35 -T14S, R 22E, St. Charles Parish(Well No. 26)

Sample Interval: 8870' to 11690'

Samples commence in carbonaceous shale of lithosome IV, and reach dark shale of lithosome V at 9650'. Sandstones are notably lacking in the interval, but considerable siltstone is present.

SOUTHERN MINERALS CORPORATION
JOS. RAT-BORNE LAND AND LUMBER NO. 1

Section 4 - T13S, R18E, St. John the Baptist Parish (Well No. 27)

Sample Interval: 10320' to 11010'

Samples are taken from lithosome V where typical dark shale and siltstone occur. Lenticular gypsiferous beds are noted.

HUMBLE OIL AND REFINING COMPANY
MIAMI CORPORATION NO. E-2

Section 44-T16S, R9E, St. Mary Parish (Well No. 28).

Sample Interval: 5500' to 11291'

Samples commence in clay, siltstone, and sandstone, typical of lithosome II, with carbonaceous beds of lithosome III reached at 5970'. Massive shale of lithosome IV occurs below 7890', and dark shale of lithosome V is penetrated at 10140'.

THE TEXAS COMPANY
WAX BAYOU CORPORATION NO. 4

Section 21 - T16S, R12E, St. Mary Parish (Well No. 29)

Sample Intervals: 9350' to 9755' and 10895' to 10961'.

The cores of the upper interval are of lithosome IV; those of the lower, lithosome V.

WARREN PETROLEUM COMPANY
SOUTHSHORE NO. 1

Section 12 - T17S , R17E, Terrebonne Parish (Well No. 30)

Sample Interval: 8700' to 13088'

Samples commence in massive, shell-bearing sand of lithosome III, with shale of lithosome IV reached at 8850'. Dark shale with siltstone of lithosome IV is penetrated at 11170'. Gypsiferous lenses are noted at about 11300'.

PHILLIPS PETROLEUM COMPANY
GAUDIN FURS NO. A-2

Section 18 - T18S , R15E, Terrebonne Parish (Well No. 31)

Sample Interval: 6000' to 10470'

Samples commence in sediments of lithosome III, with shale of lithosome IV reached at 8480'. Shale grades almost immediately into that of lithosome V, with particularly dark shale at 10300'. Significant sandstones and bentonitic siltstones occur from 9400' to the total depth.

SHELL OIL COMPANY
REALTY OPERATORS NO. C-1

Section 10 - T18S, R16E, Terrebonne Parish (Well No. 32)

Sample Interval: 2480' to 8010' and numerous cores from 8125' to 10880'

Samples commence in bentonitic clay and sand of lithosome II, with coal of lithosome III reached at 4160'. Coals and massive sands are well developed. Lithosome IV occurs below 7610' with a ferruginous, oxidized zone near the top. Lithosome V is recognized in cores below 10010'.

SHELL OIL COMPANY
PETERS NO. 3

Section 71-T18S, R18E, Terrebonne Parish (Well No. 33)

Sample Interval: 8760' to 9848'

Samples are taken from within lithosome IV where calcareous sandstones and siltstones are particularly well developed. An asphaltic siltstone occurs at 8990', a heavily oil-stained sandstone at 9420', and a diastemic break at 9460'.

SINCLAIR PRAIRIE OIL COMPANY
A. J. DUPLANTIS NO. 1

Section 12 - T18S , R18E, Terrebonne Parish (Well No. 34)

Sample Interval: 4240' to 11015'

Samples commence in clay of lithosome II, with shell beds of lithosome III reached at about 5000'. Massive olive to brown-gray shale of lithosome IV occurs below 8930', and the well bottoms in this lithology.

FOHS OIL COMPANY
BUCKLEY - BOURG NO. 1

Section 77 - T19S, R17E, Terrebonne Parish (Well No. 35)

Sample Interval: 2770' to 13377' with numerous breaks.

Samples above 3900' represent lithosome II and following a break, carbonaceous shale of lithosome III is recognized at 4250'. Lithosome IV occurs below 7660', and lithosome V occupies the interval from 10240' to the total depth.

THE TEXAS COMPANY
STATE DOG LAKE NO. 17

Section 5 - T22S, R16E, Terrebonne Parish (Well No. 36)

Sample Interval: 3535' to 6774' with numerous breaks.

Samples are core chips taken mainly from within lithosome III. Sandstone and siltstone with shells and/or calcareous matrix are most common. Crystalline gypsum is recovered at 3880'.

THE TEXAS COMPANY
VERMILION PARISH SCHOOL BOARD NO. 1

Section 16 - T13S, R4E, Vermilion Parish (Well No. 37)

Sample Interval: 1560' to 11759'

Samples commence in gravel of lithosome I, with clay of lithosome II at 2000'. Shell beds typical of lithosome III appear at 2920', causing the interval to expand at the expense of lithosome II. Massive shale of lithosome IV occurs below 6120', and dark shale of lithosome V is encountered at 9985'.

MORTAR DRILLING COMPANY
CAMP POLK WATER WELL

Vernon Parish (Well No. 38)

Sample Interval: 110' to 700'

Samples represent two members of the Fleming formation, with clays typical of lithosome II.

CAMP POLK EXPANSION WELL NO. 3

Section 26 - T1N, R8W, Vernon Parish (Well No. 39)

Sample Interval: 0' to 800'

Samples represent three members of the Fleming formation, with clays and massive sandstone typical of lithosome II.

APPENDIX C

Descriptions of Continuous Cores

CONTINENTAL OIL COMPANY CATC NAVARRE NO. A-1

Section 45 - T9S, R2E, Acadia Parish (Well No.1)

Cored Interval: 11,779' to 11,854'

11,799' Siltstone, medium dark gray, very argillaceous, slightly calcareous, with disseminated very fine-grained sand. Shale, very dark gray-brown, non-calcareous, clay, with conchoidal fracture in part.
Siltstone to very fine-grained sandstone, medium gray, resistant, with carbonaceous plant fragments in inclined bedding planes; in part platy, horizontal beds with drab brown gas stains.

11,780' No samples.

11,782' Siltstone and sandstone, as above; trace of asph.

11,783' No samples.

11,784' Siltstone to very fine-grained sandstone, light gray, very resistant, non-calcareous, with a few glauconite pellets, and seams to one inch thick of black-brown, non-calcareous, brittle, resistant shale; inclined bedding, with a few sandstone laminae. Asphalt in bedding.

11,785' Sandstone, medium gray-brown, silty, with disseminated calcite crystals and pelecypod shell fragments. Wavy mottling of red-brown ferruginous clay. Bedding is horizontal.

11,786' No samples.

11,789' Sandstone, light gray, medium to fine-grained, with interstitial very fine-grained sand and silt. Grains are sub-angular to sub-round, with overgrowths suspect. Very resistant, quartzitic. Black-brown lignitic plant remains.

11,790' Sandstone is less resistant, with bentonitic clay matrix; non-friable.

11,791' Sandstone is less well consolidated in part, with porous zones; disseminated carbonaceous fragments, glauconite pellets, and biotite flakes.

11,792' Sandstone is fine grained, with argillaceous zones; yellow, bentonitic clay, and carbonaceous material in horizontal bedding planes.

11,793' Some inclined bedding. Sandstone, light gray, very fine-grained, with black carbonaceous seams. One dark gray, platy, argillaceous siltstone, one-half inch thick, with some gradational interlamination into very resistant sandstone.

11,794' Siltstone to very fine-grained sandstone, light gray, poorly sorted, very resistant, non-calcareous.

11,795' Sandstone assumes horizontal laminae of lignitic clay. Minor diastemic break with cross-bedded sandstone below.

11,796' Sandstone, light to medium gray, very fine to fine-grained, silty, very resistant, angular; suspect of over-growth, quartzitic. Sandstone is calcareous in part. Clay, dark gray, lignitic, platy, silty in inclined beds to one-half inch thick.

11,797' Sandstone, as above, very resistant, with inclined, carbonaceous partings. Included calcareous clay.

11,798' Sandstone, as above, with small medium-grained fraction; muscovite flakes and carbonaceous fragments.

11,799' Sandstone carried red-brown, ferruginous clay pellets, less calcareous material.

11,800' Sandstone is non-calcareous; silt and very fine sand fractions predominate.

11,802' Carbonaceous fragments in inclined bedding. Siltstone, medium dark gray-brown, argillaceous. Shale, dark gray to gray-brown, blocky to platy, with conchoidal fracture, massive, no interbeds. Some disseminated silt and black carbonaceous fragments. Few floating grains of fine-grained sand, and pockets to one-fourth inch.

11,807' Sharp, inclined bedding plane contact. Siltstone, medium dark gray-brown, with pockets of light gray, fine-grained sub-round sand to two inches.

11,808' Sandstone, medium gray, very fine-grained, silty, with small fine-grained fraction; abundant black carbonaceous fragments disseminated throughout.

11,809' Carbonized leaves and leaf impressions; dark gray shale partings.

11,810' Siltstone to very fine-grained sandstone, light gray, very well consolidated, resistant, non-calcareous, quartzitic, with dark gray shale partings in inclined bedding planes.

11,812' No samples.

11,813' Siltstone, medium dark gray, very resistant. Minor diastemic break; inclined bedding. Sandstone, medium gray, very fine-grained to fine-grain sub-angular to sub-round, with disseminated calcareous fragments and carbonaceous flakes.

11,814' Carbonized plant fragments are concentrated in zones.

11,815' Sandstone, as above, with dark laminae; inclined, wavy bedding, and dark argillaceous partings. Sandstone as above, non-calcareous, very resistant.

11,816' No samples.

11,817' Sandstone as above.

11,818' Sandstone, light to medium gray, fine to medium-grained, sub-angular, quartzitic with overgrowth suspect, very resistant with siliceous cement.

11,819' Sandstone, light to medium gray, fine to medium-grained, with a few frosted coarse grains. Some small calcareous shell debris; much carbonaceous plant material. Glauconite pellets, galls and irregular intercalations of medium-dark gray carbonaceous and ashy clay. Light and medium gray laminations.

11,821' Sandstone, as above, porous; subhedral grains, few glauconite pellets, and little carbonaceous material.

11,822' Sandstone, is somewhat more coarse, very porous, somewhat friable.

11,823' Olive green, glauconitic clay zone, with disseminated very fine pyrite in sandstone as above; non-calcareous, porous.

11,824' Sandstone, as above, porous, friable, slightly calcareous; small coarse-grained fraction.

11,825' Sandstone, as above, with intercalations of siltstone, medium gray-brown, platy, with argillaceous, carbonaceous interlaminations.

11,828' Siltstone, medium dark gray, with some color lamination, grading to very fine-grained sandstone, very resistant, with abundant disseminated carbonaceous fragments. Dark red-brown, ferruginous zone, to one inch thick; inclined bedding.

11,829' Sharp contact. Sandstone, medium gray, fine to medium-grained, fairly well-sorted, sub-angular to sub-round, glauconitic, porous somewhat friable, calcareous.

11,830' No samples.

11,831' Sandstone, light gray, fine to medium-grained, sub-angular to sub-round, silty, non-calcareous, porous but non-friable; with few glauconite pellets and seams of carbonized plant material.

11,832' Diastemic break in inclined bedding of carbonaceous seams. Cross-bedding in very resistant, very fine-grained, silty sandstone.

11,833' Sandstone, medium gray, very fine to fine-grained, silty, with laminae, near horizontal black carbonaceous seams, and yellow bentonitic clay.

11,834' Sandstone, light gray, very fine to fine-grained, as above. Sandstone, light gray, fine to medium-grained, sub-angular, porous, friable, somewhat calcareous.

11,836' Sandstone texture grades to fine-grained resistant, porous, well consolidated.

11,837' Sandstone, as above, somewhat friable, micaceous, with steeply inclined bedding or cross-bedding of black carbonaceous seams.

11,838' Disseminated dark carbonaceous fragments and seams to one-fourth inch of dark gray, argillaceous, carbonaceous siltstone; steeply inclined bedding.

11,840' Diastemic break. Siltstone, medium dark gray-brown, with very fine-grained sand fraction, seams to one-fourth inch of carbonaceous shale, and abundant carbonaceous fragments; horizontal bedding.

11,842' No samples.

11,843' Siltstone to very fine-grained sandstone as above, with lenticular intercalations of light gray sandstone.

11,844' Sandstone, light gray, fine-grained to medium-grained, sub-angular, porous, friable, silty, with some rounded, frosted grains.

11,846' Carbonized plant fragments.

11,847' Small coarse-grained fraction.

11,850' Siltstone to very fine-grained sandstone, very resistant, quartzitic, non-porous.

11,851' Sandstone, fine to medium-grained, light gray, as above, with intercalations of irregular nodular siltstone and clay galls to one inch.

11,852' Siltstone as above; very resistant.

11,853' Pockets or nodular intercalations of light gray, fine to medium-grained sandstone in irregular argillaceous siltstone; carbonaceous fragments. Siltstone, medium-dark gray, very resistant, inclined bedding.

SUPERIOR OIL COMPANY MARTIN PETITJEAN NO. 1

Section 20-T9S, R2E, Acadia Parish (Well No. 2)

Cored Interval: 16,122' to 16,182'

16,122' Sandstone, light gray, very fine to fine-grained,

fairly well-sorted, sub-angular, clean, porous, with occasional glauconitic and bentonitic clay pellets, carbonaceous flakes; very dark gray argillaceous filling in organic burrows.

16,123' Sandstone is mostly fine-grained with very small medium-grained fraction; otherwise as above.

16,124' Sandstone as above; little clay or glauconite.

16,125' Sandstone as above; few dark laminae and organic burrow, dark gray argillaceous zone to one-half inch.

16,126' Sandstone as above; few dark carbonaceous laminae and partings, black, micaceous.

16,127' Sandstone, as above; massive.

16,128' Sandstone as above; few carbonaceous laminae. Contaminants in medium sand grains.

16,129' Sandstone as above, with somewhat larger medium-grained sand fraction.

16,130' Sandstone, light gray to gray-brown, very fine to fine-grained, with small medium-grained sand fraction, rather poorly-sorted, resistant, well indurated, calcareous, with white weathered shell fragments, organic burrows.

16,131' Sandstone, as above, non-calcareous, with oriented disseminated carbonaceous flakes, mica; thin partings.

16,132' Interstitial clay, white bentonitic. Sandstone, as above, with numerous black carbonaceous laminae, in part cross-beded. Few partings, some with shallow organic burrows.

16,133' Sandstone, as above.

16,134' Sandstone, as above, irregular, nodular partings.

16,135' Sandstone, as above, very slightly calcareous, with few carbonaceous laminae and flake concentrations.

16,136' Sandstone as above, massive but for one carbonaceous parting of one-half inch.

16,137' Sandstone as above; two thin, nodular partings

and some oriented carbonaceous flake concentrations.

16,138' Shale, very dark gray-brown, somewhat brittle, resistant, non-calcareous, platy clay, with biotite. Intercalations of sandstone.

16,139' Shale, as above, with carbonaceous flakes in partings. Banded with thin interbeds of medium gray, resistant siltstone to one-fourth inch.

16,140' Sandstone, light to medium gray, very fine to fine-grained, with carbonaceous laminae near top, massive below.

16,141' Sandstone grades to very fine and fine-grained, massive, as above.

16,142' Sandstone, as above, with large carbonaceous flakes and few nodular partings.

16,143' Sandstone, as above.

16,144' Sandstone, as above, in thin beds with carbonaceous shale partings. Shale, very dark gray-brown, platy, silty, with carbonaceous leaves.

16,145' Shale, as above, with dark gray-brown siltstone interbeds. Siltstone, massive, very resistant.

16,146' Siltstone grading to very fine-grained sandstone; dark gray-brown, resistant. Sandstone, light to medium gray, very fine-grained, uniform with faint laminations.

16,147' Sandstone, light gray, very fine-grained to fine-grained, massive, resistant.

16,148' Sandstone is mostly fine-grained; irregular, lenticular carbonaceous shale partings, with organic burrows.

16,149' Sandstone, as above; massive.

16,150' Sandstone, as above.

16,151' Sandstone is fine-grained, with carbonaceous parting.

16,152' Sandstone, as above, slightly calcareous, with few carbonaceous partings.

16,153' Sandstone, as above, few compressed clay blebs.

16,154' Shale, very dark gray-brown, platy, somewhat resistant, with irregular, lenticular intercalations of sandstone, medium gray, very fine-grained to medium-grained.

16,155' Sandstone, light gray, predominately fine-grained, with vertical burrows; gas stain.

16,156' Shale and sandstone, as above, in thin intercalations and irregular, wavy interlaminations.

16,157' Shale and sandstone, as above, vertical organic borings.

16,158' Sandstone predominates, with thin lenticular clay intercalations. Numerous organic burrows and borings, soft sediment flow invasions. Thin carbonaceous shale partings and laminae.

16,159' Sandstone, light gray, fine-grained, sub-angular to sub-round, clean, in thin platy beds with vertical organic structures; gas stain.

16,160' Sandstone, as above, with few carbonaceous shale partings and disseminated carbonaceous flakes.

16,161' Sandstone, light gray, fine to medium-grained, not well-sorted, slightly friable, angular to sub-angular, somewhat porous.

16,162' Sandstone, as above, few partings.

16,163' Sandstone, as above, few laminae.

16,168' Sandstone, as above, with medium gray clay laminae; thin-bedded. Irregular carbonaceous shale intercalations.

16,169' Sandstone, as above, massive. Partings of carbonaceous shale and siltstone to one-fourth inch.

16,170' Sandstone, as above, massive.

16,171' Sandstone, as above, with few irregular concentrations of carbonaceous flakes and leaves.

16,172' Sandstone, as above, with irregular, carbonaceous shale partings. Clay-filled, vertical borings.

16,173' Sandstone, as above, massive.

16,174' Sandstone, as above, with numerous irregular, waxy, carbonaceous laminae. Siltstone, dark gray, argillaceous, carbonaceous, in irregular interlamination with sandstone.

16,175' Sandstone, light gray, fine-grained, uniform, massive, resistant.

16,176' Sandstone, as above, with few irregular, wavy, carbonaceous laminae, and vertical and horizontal burrows.

16,177' Sandstone, light gray, somewhat more coarse-grained than above; fine to medium-grained.

16,178' Sandstone is mostly fine-grained. Numerous carbonaceous laminae, grading to carbonaceous siltstone to one-fourth inch.

16,179' Siltstone, very dark gray, platy, argillaceous, resistant.

16,180' Sandstone, as above, massive.

16,181' Sandstone, as above, with irregular partings to one-fourth inch, argillaceous, carbonaceous. Few laminations and intercalations or flattened galls of very dark gray clay.

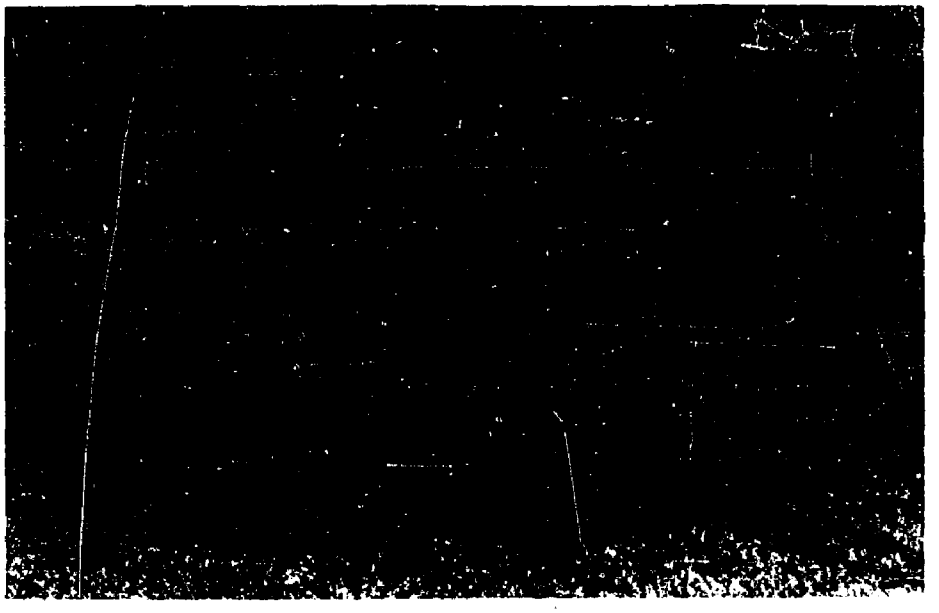

Figure 41 Polished section of fine-grained, light gray sandstone with black, carbonaceous laminations (X5).

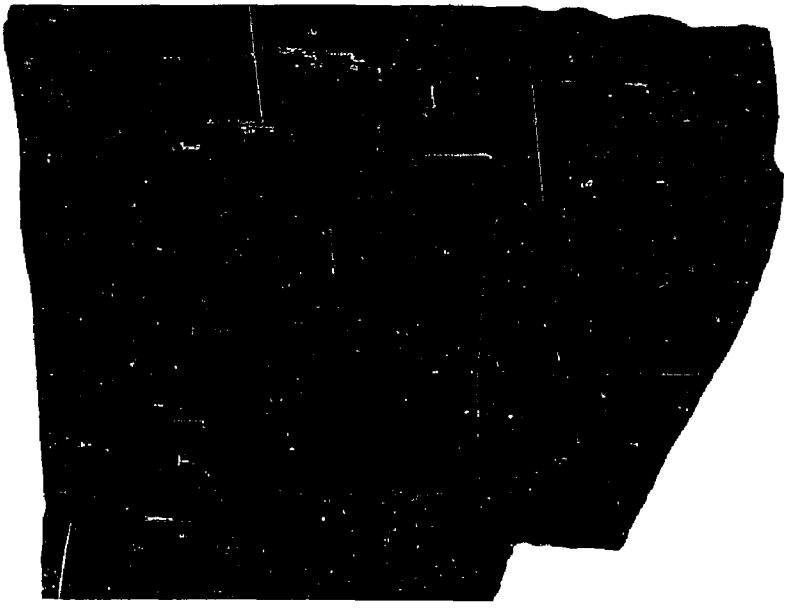

Figure 42 Polished section of thin-bedded and laminated siltstone and shale with low-angle cross-bedding (X1.5)

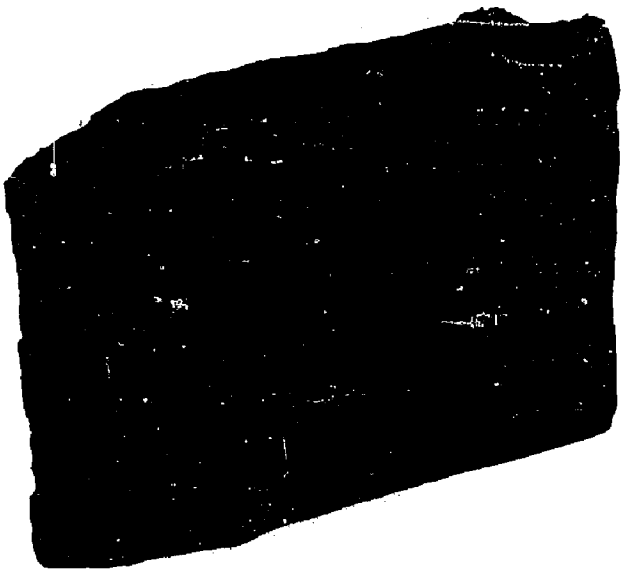

Figure 43 Polished section of light gray, fine-grained sandstone with numerous dark laminations and a shale seam at the base (X1.5).

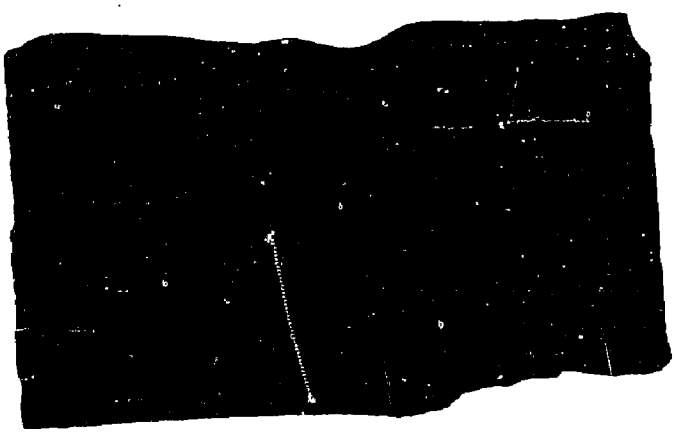

Figure 44 Polished section of medium gray, cross-bedded siltstone with thin dark shales (X1.5)

Figure 45 Cross-bedding in alternating very fine-grained, light gray sandstone, and dark siltstone in polished section (X5).

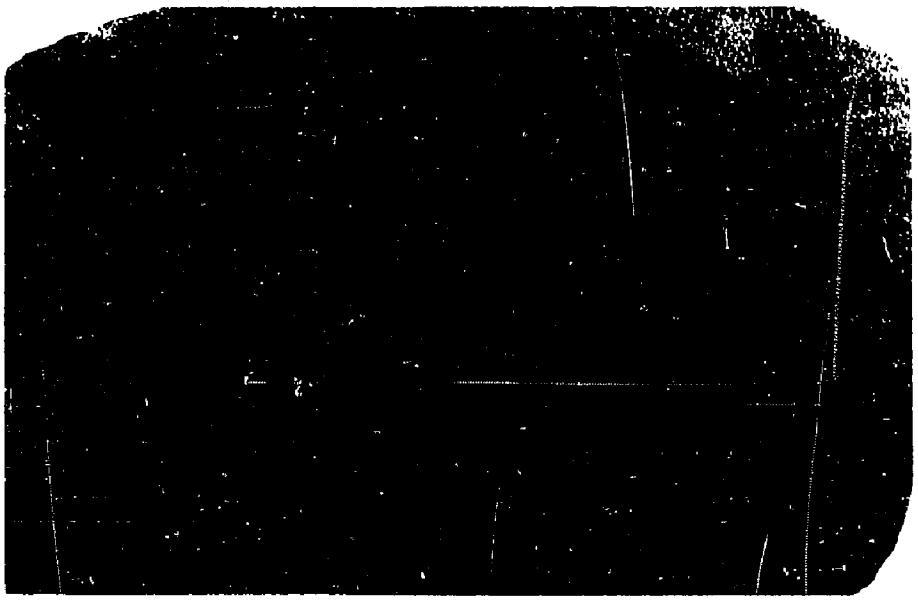

Figure 46 Random dissemination of black, carbonized plant fragments in very fine-grained sandstone polished section (X5).

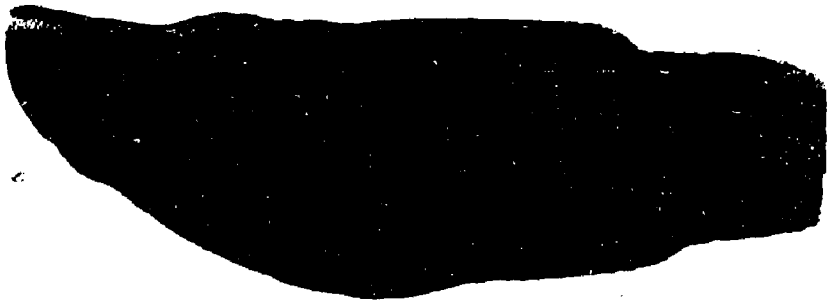

Figure 47 Polished section of a dark gray, intercalated mixed rock, composed mainly of silt and clay with carbonaceous flakes (X1.5).

Figure 48 Polished section of a medium gray mixed rock showing the work of burrowing organisms. (X1.5).

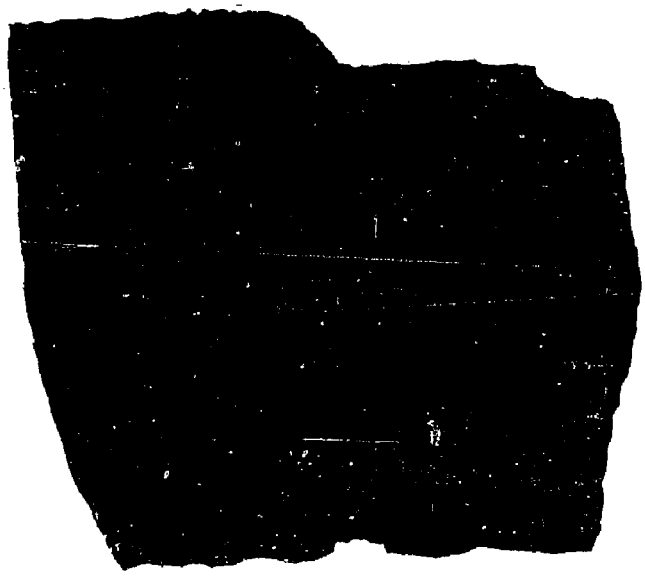

Figure 49 Polished section of a light gray, fine-grained sandstone penetrated by a boring (X1.5).

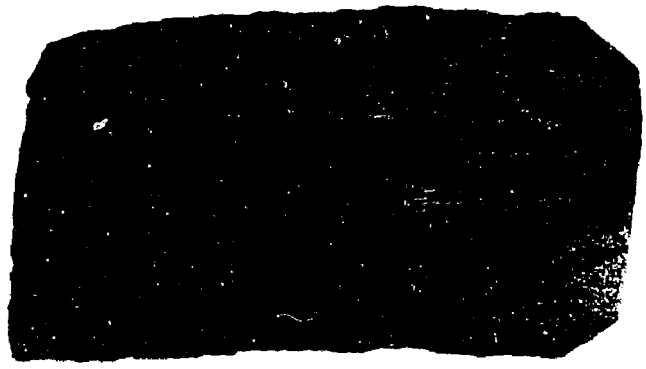

Figure 50 Polished section showing burrows in shale and very fine-grained sandstone (X1.5).

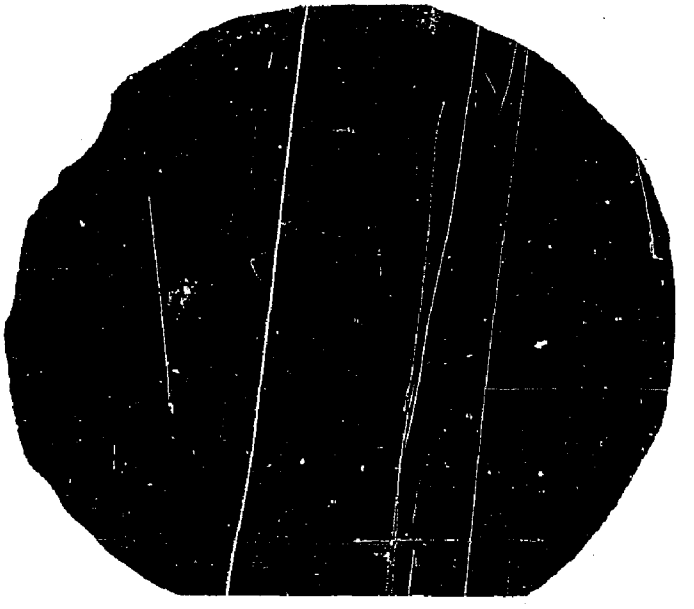

Figure 51 Bedding plane parting in a core with an organic trail in very fine-grained sandstone (X1.5).

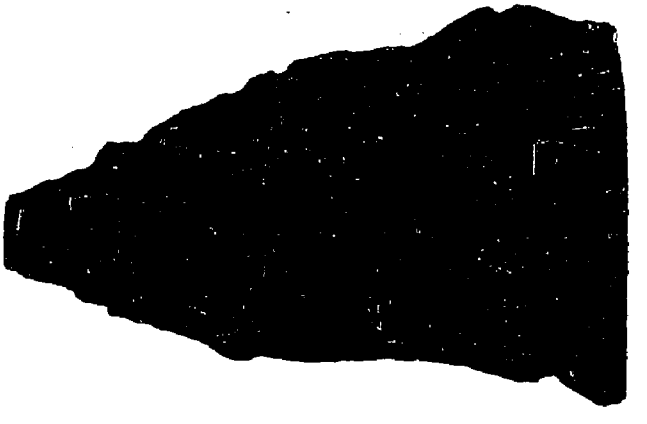

Figure 52 Polished section of light gray, very fine-grained sandstone with numerous borings (X1.5).

APPENDIX D

Descriptions of Thin Sections

Thin Section No. 1

Continental, Navarre No. A-1 Depth: 11,792'

Sandstone, fine-grained, massive except for micro-lenses of light-colored clay. Quartz grains are mostly angular and interlocking, with little interstitial filler in most of the section. Quartz grains exhibit dust and mineral grain inclusions and have simple extinction except for a few mosaic grains. Feldspars are not abundant, and usually show some alteration to sericite. Glauconite pellets are noted. Rarity of light-colored clay and sericite in some zones and abundance in others produces bedding. Specks and flakes of dark carbonaceous clay are present; heavy minerals are very rare.

Proportions by composition: quartz 76%, clay 9%, mica 5%, feldspar 4%, carbonaceous fragments 4%, micro-quartz 2%.

Quartz size proportions: coarse silt 0%, very fine sand 10%, fine sand 47%, medium sand 19%. Quartz is 88% angular; 12% rounded.

This is a clean, not well-sorted orthoquartzite with thin, argillaceous intercalations. It occurs at an interval of mixed rocks with disrupted bedding structures.

Thin Section No. 2

Continental, Navarre No. A-1 Depth: 11,800'

Sandstone, very fine to fine-grained with clay matrix. Grains do not interlock, but stud the matrix; they are almost exclusively angular. Grains exhibit pink mineral grain inclusions and have simple extinction, except for a few mosaic grains. Feldspars are mostly altered to clay which constitutes most of the matrix. Carbonaceous flakes are present; glauconite pellets are rare, tourmaline rarer.

Proportions by composition: quartz 59%, clay 31%, microquartz 7%, rock fragments 3%, feldspar 2%, mica 1%.

Quartz size proportions: coarse silt 0%, very fine sand 25%, fine sand 32%, medium sand 2%. Quartz is 95% angular; 5% rounded.

This is an intermediate colored, fairly well-sorted, low-rank graywacke. Most of the feldspars are altered.

Thin Section No. 3

Continental, Navarre No. A-1 Depth: 11,815'

Sandstone, very fine grained, with dark, carbonaceous interstitial clay. Concentrations of clay produce laminations. Quartz grains are angular, almost without exception. They exhibit dust and mineral grain inclusions and have simple extinction. Loosely and tightly packed bands alternate. Feldspars are mostly altered to sericite and clay, but if unaltered, occur as clevage fragments of very fine grain-size; some twinning. Matrix also includes chlorite and sericite. A few flakes of robust mica are noted, as are tourmaline and zircon.

Proportions by composition: quartz 53%, clay 23%, feldspar 12%, sericite and chlorite 6%, micro-quartz 4%, heavy minerals 1%.

Quartz size proportions: coarse silt 6%, very fine sand 44%, fine sand 3%, medium sand 0%. Quartz is 94% angular; 6% rounded.

This sandstone is well sorted, but has planar sedimentary structures due to inhomogeniety of matrix. Color alternates from light to medium gray to make it grade toward a mixed rock. It is a feldspathic rock with post depositional alteration.

Thin Section No. 4

Continental, Navarre No. A-1 Depth: 11,832'

Sandstone, very fine-grained, with argillaceous and clean zones alternating. Carbonaceous clay seams are compacted into wavy laminae around grains. Quartz is almost exclusively angular. Grains exhibit dust and mineral inclusions and have simple extinction. Feldspars are very fine grain-sized; many are twinned. Carbonaceous clay and sericite are abundant, and chlorite and glauconite are noted.

Proportions by composition: quartz 44%, clay 28%, chlorite and sericite 16%, micro-quartz 6%, feldspar, 5%, tourmaline 1%.

Quartz size proportions: coarse silt 4%, very fine sand 34%, fine sand 6%, medium sand 0%.

This quartz-poor rock exhibits color variegation due to concentrations of carbonaceous clay. It has laminations and grades toward a mixed rock. Sorting of quartz grains is good.

Thin Section No. 5

Continental Navarre No. A-1 Depth: 11,827'

Sandstone, fine-grained, argillaceous, massive. Quartz grains are mostly angular, with dust, bubbles, and mineral inclusions; extinction is mostly simple, partly mosaic. Feldspars are abundant, some showing little or no alteration. Some are large (medium grain and above) and many show twinning. Matrix consists of clay and sericite alteration products and flakes and concentrations of carbonaceous material are present but do not form laminae.

Proportions by composition: quartz 61%, clay 14%, feldspar 11%, mica 7%, micro-quartz 4%, rock fragments 2%, glauconite 1%.

Quartz size proportions: coarse silt 0%, very fine sand 9%, fine sand 41%, medium sand 11%. Quartz is 89% angular; 11% rounded.

This is a light-colored, fine-grained, well-sorted, massive sandstone. It is fairly rich in feldspars and their alteration products.

Thin Section No. 6

Continental, Navarre No. A-1 Depth: 11,841'

Siltstone, argillaceous, or silty shale, with a very fine-grained sand fraction. Quartz is in short supply and entirely angular, with mineral inclusions and simple extinction. A few twinned feldspars of very fine to fine grain size are present. Matrix is clay and sericite in which grains are loosely packed.

Proportions by composition: quartz 37%, clay 36%, micas 14%, micro-quartz 12%, rock fragments 1%.

Quartz size proportions: coarse silt 19%, very fine sand 16%, fine sand 2%, medium sand 0%. Quartz is 100% angular.

This is a dark-colored, argillaceous siltstone or silty claystone, with admixture of very fine sand. It grades toward a mixed rock, but appears to have a single grain-size curve optimum.

Thin Section No. 7

Continental, Navarre No. A-1 Depth: 11,843'

Shale, arenaceous and silty, with lamination of carbonaceous clay and bedding produced by concentrations of quartz grains. Quartz is in short supply; grains are angular, exhibit dust and mineral inclusions, and have simple extinction. Feldspars are mostly altered, but a few very fine sand sized clevage fragments are present. Matrix is mostly carbonaceous clay and sericite.

Proportions by composition: clay and sericite 60%, quartz 22%, feldspar 15%, robust mica 3%, zircon 1%.

Quartz size proportions: coarse silt 13%, very fine sand 9%, fine sand 0%, medium sand 0%. Quartz is 100% angular.

This is a dark-colored, silty-argillaceous, lenticular mixed rock. It is poorly-sorted and rich in clay, mica, and feldspar.

Thin Section No. 8

Continental, Navarre No. A-1 Depth: 11,848'

Sandstone, fine-grained, feldspathic. Quartz grains are almost exclusively angular, exhibit mineral grain inclusions, and have simple extinction. Feldspars are mostly twinned clevage fragments of fine grain size, with fractures. Matrix is mostly light-colored clay and sericite.

Proportions by composition: coarse silt 0%, very fine sand 11%, fine sand 36%, medium sand 4%. Quartz is 98% angular; 2% rounded.

This is a light-colored, fairly well-sorted,

fine-grained massive graywacke. Proportion of quartz is low; feldspars are abundant.

Thin Section No. 9

Continental, Navarre No. A-1 Depth: 11,850'

Sandstone, very fine-grained, massive, fairly well sorted. Virtually all quartz grains are angular, exhibit mineral inclusions, and have simple extinction. A few feldspars of fine grain size are present; some are twinned. Matrix is composed chiefly of alteration products of feldspars.

Proportions by composition: quartz 70%, clay 18%, micro-quartz 5%, feldspar 2%, mica 2%, zircon 2%, rock fragments 1%.

Quartz size proportions: coarse silt 6%, very fine sand 51%, fine sand 13%, medium sand 0%. Quartz is 99% angular; 1% rounded.

This is light-colored, very fine-grained, low-rank graywacke.

Thin Section No. 10

Continental, Navarre No. A-1 Depth: 11,852'

Siltstone to very fine-grained sandstone, with small fine-grained fraction, very argillaceous, massive but poorly sorted. Quartz is almost entirely angular, exhibits mineral inclusions, and has mostly simple extinction, but some mosaic and undulose grains. Feldspars are rare. Matrix is composed of dark carbonaceous clay and some mica. No heavy minerals are noted.

Proportions by composition: quartz 54%, clay 23%, micro-quartz 11%, mica 8%, feldspar 4%.

Quartz size proportions: coarse silt 27%, very fine sand 24%, fine sand 3%, medium sand 0%. Quartz is 94% angular; 6% rounded.

This is a dark-colored, arenaceous-argillaceous siltstone, with textural intercalations.

Thin Section No. 11

Superior, Petitjean No. 1 Depth: 16,130'

Sandstone, fine-grained, with bands of size-sorting differentials. Finer grains are cemented with clay, coarser grains with calcite. Quartz grains are mostly angular, exhibit mineral inclusions, and have simple extinction. Grains interlock in tight packing of clay but do not touch in loose packing of calcite. Feldspars are present in fairly good state of preservation. Carbonaceous fragments are concentrated in wavy laminae. Small zircons are noted.

Proportions by composition: quartz 62%, calcite 18%, clay 11%, feldspar 11%, mica 2%.

Quartz size proportions: coarse silt 0%, very fine sand 2%, fine sand 45%, medium sand 14%, coarse sand 1%. Quartz is 74% angular; 26% rounded.

This is an intermediate-colored, fairly well-sorted, fine-grained, sub-massive rock, with faint color banding due to alternation of feldspathic and calcareous sandstone. Quartz grains float in crystalline calcite in testimony of former physical stability of parent shell material.

Thin Section No. 12

Superior, Petitjean No. 1 Depth: 16,133'

Sandstone, fine-grained, with argillaceous bands and dark carbonaceous laminations. Quartz grains are virtually all angular, exhibit dust and mineral inclusions, and have simple extinction. Grains are not touching in argillaceous zones, interlock elsewhere. Feldspars are mostly altered, or have ragged boundaries. Carbonaceous fragments are disseminated and concentrated in wavy laminae. Small zircons and glauconite pellets are noted.

Proportions by composition: quartz 57%, clay 19%, feldspar 13%, mica 8%, microquartz 3%.

Quartz size proportions: coarse silt 0%, very fine sand 14%, fine sand 39%, medium sand 4%. Quartz is 98% angular; 2% rounded.

This is an intermediate-colored, fine-grained sandstone with planar structures. Thin beds of graywacke and orthoquartzitic sandstone alternate.

Thin Section No. 13

Superior, Petitjean No. 1 Depth: 16,147'

Sandstone, poorly-sorted very fine to fine-grained, studed with a few larger grains and calcite inclusions, massive. Quartz grains are angular, exhibit dust and mineral inclusions, and have simple extinction. Grains are mostly interlocking. Feldspars are abundant and largely unaltered; robust mica is noted. Light-colored clay occurs as included pellets as well as interstitial filler. Carbonaceous fragments are disseminated. A preferential orientation of grains in the bedding direction is noted. Rutile and hornblende are present.

Proportions by composition: quartz 50%, clay 18%, feldspar 17%, micro-quartz 6%, mica 6%, calcite 3%.

Quartz size proportions: coarse silt 0%, very fine sand 20%, fine sand 25%, medium sand 5%. Quartz is 100 angular.

This is a light-colored, not well-sorted, very fine-grained, massive, rock. It is a low-rank graywacke with feldspathic zones.

Thin Section No. 14

Superior, Petitjean No. 1 Depth: 16,155'

Mixed rock with fine-grained sand studding matrix of carbonaceous clay and sericite. Quartz grains are almost entirely angular, exhibit dust and mineral inclusions, and have simple and mosaic extinction. Few unaltered feldspars are present; carbonaceous clay and sericite are particularly abundant.

Proportions by composition: quartz 42%, clay and sericite 36%, micro-quartz 7%, feldspar 6%, robust mica 5%, heavy and opaque minerals 2%, rock fragments 1%.

Quartz size proportions: coarse silt 3%, very fine sand 12%, fine sand 26%, medium sand 1%. Quartz is 96% angular; 4% rounded.

This is a dark mixed rock with dual grain-size optima expressed as clay studed with quartz grains. Sand and shale are intercalated, as well.

Thin Section No. 15

Superior, Petitjean No. 1 Depth: 16,158'

Sandstone, fine-grained with variations in packing. Quartz grains are mostly angular, exhibit dust and bubble inclusions, and have simple to mosaic extinction. Feldspars are abundant and largely unaltered. Light-colored clay occurs as interstitial filler and as included bodies. A few carbonaceous flakes are disseminated; rare glauconite pellets and chert granules are noted.

Proportions by composition: quartz 52%, feldspars 19%, clay 17%, mica 7%, micro-quartz 3%, rock fragments 2%.

Quartz size proportions: coarse silt 0%, very fine sand 5%, fine sand 34%, medium sand 13%. Quartz is 92% angular; 8% rounded.

This is an intermediate-colored rock with planar structures grading toward intercalations. Sorting is fair, but matrix produces variability in packing. It is a low-rank graywacke.

Thin Section No. 16

Superior, Pettitjean No. 1 Depth: 16,179

Sandstone, medium-grained, massive,. Quartz grains are mostly angular, interlocking with little matrix, exhibit mineral inclusions, and have simple extinction. The few feldspars which are present are largely altered to sericite and clay. Light-colored clay pellets are present; no heavy minerals or carbonaceous material is noted.

Proportions by composition: quartz 72%, clay 17%, feldspar 7%, micro-quartz 2%, quartz pebble 1%.

Quartz size proportions: coarse silt 0%, very fine sand 1%, fine sand 17%, medium sand 40%, coarse sand 14%. Quartz is 90% angular; 10% rounded.

This is a light-colored, uniform, fairly well sorted, quartz-rich rock. It is the most coarse-grained rock present in the continuous cores.

Figure 53 Thin section cut from medium-grained sandstone, showing interlocking of partially rounded quartz grains with little interstitial filled (X40).

Figure 54 Thin section cut from fine-grained sandstone with interlocking, contaminated quartz and an irregular seam of dark carbonaceous clay. (X40).

Figure 55 Thin section cut from fine-grained sandstone with angular quartz grains floating in matrix of largely altered feldspar (X40).

Figure 56 Thin section cut from poorly-sorted sandstone with dark, carbonaceous interstitial clay (X40).

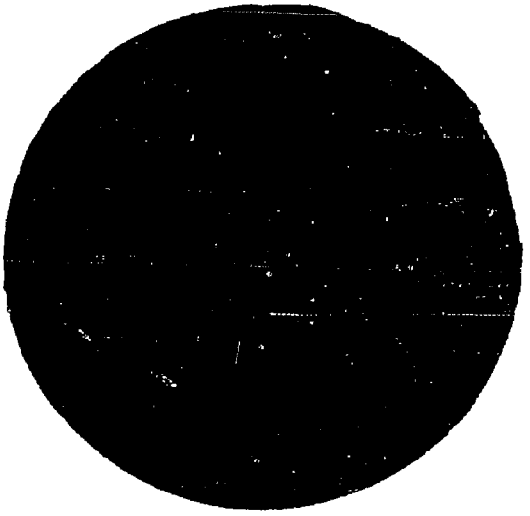

Figure 57 Thin section cut from poorly-sorted, very fine-grained, silty sandstone with carbonaceous clay matrix (X40).

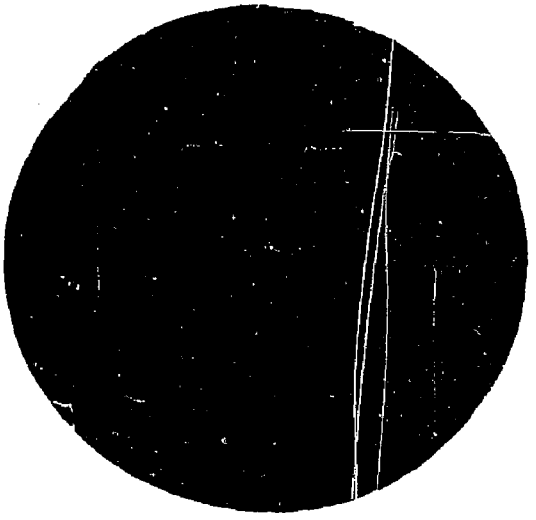

Figure 58 Thin section cut from argillaceous siltstone studed with fine sand-sized quartz grains (X40).

VITA

Stuart T. Watson was born in Des Moines, Iowa, on June 6, 1930. He attended elementary school in Indianola, Iowa, and graduated from Kemper Military School, Boonville, Missouri in 1948. He served in the United States Naval Reserve as gunners mate and Ensign, and attended Simpson College, Indianola, Iowa, graduating in 1953. He received a Master of Science degree in geology from the University of Nebraska, in 1955, and joined the Exploration Department of the Sinclair Oil & Gas Company, Tulsa, Oklahoma, as a stratigrapher. In 1963 he entered the graduate school at Louisiana State University, and is now a candidate for the Ph.D. degree in geology. He is married to the former Henrietta Reifenrath of Wynot, Nebraska, and has two children, Rebecca and Jeffrey.

EXAMINATION AND THESIS REPORT

Candidate: Stuart T. Watson

Major Field: Geology

Title of Thesis: Petrography and Lithostratigraphy of Some South Louisiana Subsurface Tertiary Rocks.

Approved:

John C. Ahern & C. O. Durham
Major Professor and Chairman

Max Goodrich
Dean of the Graduate School

EXAMINING COMMITTEE:

R. E. Goodberg

J. K. Kupfer

H. V. Andersen

Date of Examination:

May 11, 1965